THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1914 EDITION

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WAGES AND CONDITIONS OF LONDON ELECTRICAL WORKERS.

THE agitation among the workers in many branches of industry for higher wages and better conditions, now faces the electrical contracting trade in the London district. Two meetings have been held during this week which have shown that the situation may become a serious one, leading to widespread open conflict unless it is handled with the utmost discretion and with a desire on both sides for peace.

We profoundly hope that some way may be found of averting what could only be a calamity.

Let us as briefly as we can state the position. There are said to be 3,000 electrical workers in the London district. Of these, it is understood, 1,800 are now members of the Electrical Trades Union. The officials of that Union base a claim for higher wages upon the increase in the cost of living, and they quote the Board of Trade Labour statistics to show that that increase amounts to 16·8 per cent. since 1900. They ask, for example, that the 9½d. per hour paid to wiremen should be increased to 11d., which they say is only an advance of 8·7 per cent. (we make it 15·8 per cent.), and they also want alterations in conditions as to working hours, overtime and many other matters. Now, if this had been all, the position would have been simpler than it actually is. Such matters afford a basis for negotiations, and, as a matter of fact, both masters and men express themselves agreed that the time has arrived for their consideration. What is it that prevents calm and dispassionate round-table discussion as to what are fair rates of payment? Apparently several months ago there were certain pourparlers between the Electrical Trades Union and the London Electrical Masters' Association, but the latter body declined to negotiate save on certain stipulated conditions. These conditions were strongly objected to by the Union: they refused to discuss matters with their hands tied behind their backs, and desired the questions at issue to be discussed on their merits. The next step was for the L.E.M.A. to issue the notice published in our issue of January 16th calling a meeting at Caxton Hall for Tuesday last, and intimating their desire to improve the status of all electrical workers, whether connected with any organisation or not, with a view to appointing a committee of masters and men to draw up a code of working rules and fix wages and terms of employment. It was this action which enraged the Electrical Trades Union, and they summoned a mass meeting for Monday night last at the Memorial Hall.

We made it our business to attend both of the above gatherings with a view to ascertaining the exact position and forming a fair opinion regarding the dispute. The meeting called by the Union filled the Memorial Hall to its utmost capacity. The throng of 1,500 or so was of one mind; it was too easily carried away at times when the floodgates of Socialistic oratory were opened and abuse was levelled at particular contractors, but there was fre-

quently the saving grace of humour. Laughter was easy, whether occasioned by the imitation of a "cuckoo!" which punctuated speeches at more or less appropriate points, or by the shrill effeminate voice which had a way of crying right above the rest "Hear! hear!," moving to merriment just as some orator or other had been breathing out his threatenings and slaughters, and perhaps was priding himself upon having got home that time, at any rate. Now why was there this humour, this readiness to listen to pretty stories about drowning men with wigs and paper collars, who could not be rescued because they, "like you men, will not hang together"; and about landladies who didn't know how to cook sausages, and said that "when you had cleaned 'em out there wasn't much left of 'em?" The lighter vein of the meeting indicated either that the electrical workers had an unbounded confidence in their cause and felt sure of winning, or else that there were many present who had no life and death interest in the matter.

We must judge things as we find them, and we have dealt with the humour. But there was a deep and serious determination which possessed the whole gathering. It had a conviction that the London Electrical Masters' Association was "out" to "smash the Union"; if that were so, the men were prepared to go any length, it was an infringement of their personal rights and liberties. Men had fought and died for such things as these in the past—they would do so again. Now this, and a great deal of anti-capitalistic froth and Socialistic idealism, may have been merely used to attract members to the E.T.U.—50 were added during the evening—but it may not. There may be some good ground for the men's resentment at the Masters' action when dealing with them in the earlier stages, or there may not. There may have been wisdom in the London Electrical Masters' Association ignoring the Union to such an extent as to omit to send a card to the Union's secretary admitting him to Tuesday's meeting—there may not. We prefer not to decide these points. We are more concerned to prevent a conflict. So far there may have been misunderstandings on both sides, we have nothing to do with that now. We prefer to deal with the position as it stands. The masters at their meeting of workers on Tuesday did not have things as much their own way as they desired. The non-union working element in the Hall was very small, and, generally speaking, was weak. That there is a strong non-unionist case we have shown again and again, and several of the employers indicated strongly their own views, but the non-unionist speakers among the men were not sufficiently representative of the strong case that they might advance for individual liberty. As matters stand both Unionist and non-Unionist are demanding liberty—the Unionist the right to organise, the non-Unionist the right to remain unorganised. But the fly in the ointment is the intolerant spirit of the Unionist toward other men who prefer to remain free. If the members of the Electrical Trades Union mean to conduct their part of the negotiations, which we hope will ensue, in the abominable spirit shown by some of their orators of Monday last, then we cannot feel hopeful of success. We prefer not to print all the ugly things that were said by way of abuse of the non-Unionist, the capitalist and individual electrical employers—we prefer not to embitter the controversy—but we have them in reserve. At the moment we merely treat them as the heated utterances of men who thought that the electrical employers of London were intent on "union-smashing." Several well-known electrical contracting employers on Tuesday night disowned any such intention, and we believe that their fair and frank statements made a good impression on the 50 or more representatives of the Union who were among the delegates. They are compelled, however, so long as there is a large proportion of electrical labour out of the Unions, to pay regard to that element as well, and ensure, as far as may be in their power, that its interests shall be studied. We have repeatedly stated in these pages our views on freedom of labour. We recognise that Trade Unions have a very important non-political place to fill in endeavouring to ameliorate the lot of the worker, also that to try to stop the organisation of workers is both undesirable and futile at this date. Organised employers in the future will have to meet organised labour. The electrical masters declared that they have no desire to fight the Unions, but they are prevented from negotiating with them by their own action in denying the masters the right to give free and Union labour equal rights to work.

The intention of the L.E.M.A. was to pass the following resolution :—

That a Committee of Workmen's Representatives be appointed consisting of 12 members (not more than one representative from any one firm) to meet the Committee of the London Electrical Masters' Association with a view to agreeing working rules, and terms and conditions of employment.

Eventually, however, that resolution was withdrawn, as Union rules would have debarred any Union man from acting on such a committee, and an amendment moved by a member of the E.T.U. District Committee, who argued with considerable fairness and some ability, and seconded by Mr. Ebben, the secretary of the Association of Electrical Station Engineers, was carried by an overwhelming majority, as follows :—

That the resolution put forward by the Electrical Masters' Association be referred back to the two organisations, the Electrical Trades Union and the Association of Electrical Station Engineers.

What the next step may be we cannot now say. The exact meaning and drift of the amendment is not clear. How the resolution, which only came before the meeting for the first time on Tuesday, could be referred back to those who had never had it before them, we know not, but we presume it amounts to this, that the two Associations will put their heads together (it was stated on Monday that the A.E.S.E. had thrown in its lot with the Union), and do something toward the appointment of a committee to meet the Masters' Committee. If that be the case, and the masters agree to waive their conditions meanwhile, there is a free way for matters to be considered fully. But if the Union continues to adopt the attitude of open hostility to the non-Union worker and declines to work beside him, or at best continues to make life intolerable to him, then that is a rock on which the ship will split. If Unionists mean it when they say, as they do say, "Let us have peace!" "We do not want war!" then they must not expect to dictate all the terms, and they must certainly moderate their attitude towards the non-Unionist.

Very many interesting points came under discussion at both of the meetings referred to, such as the grading of men, black-listing, inefficient work, apprentices, under-cutting of labour, and under-cutting of contractors' charges to clients, how long a period of training and experience is required in order to make a wireman efficient and so on—but these we cannot deal with now.

We will content ourselves with hoping for a peaceful settlement of the whole of the differences. We note with regret, however, that the E.T.U. Secretary is reported to have stated that the acceptance of the amendment will not affect the position with regard to the building strike at all. "In every case where the Building Trades Federation took action their men would come out automatically."

The Telephone Service.

While the volume of complaint regarding the British telephone service intermittently swells and dies away, it never ceases for long. Granted that the Post Office has had its hands full of work arising out of the transfer, and due very largely to the inexcusable neglect of the Government to make proper arrangements with the National Telephone Co. for the vigorous development of the system during the years immediately preceding the transfer, the fact remains that two years have elapsed since the Post Office took charge of the undertaking, and still the service is not satisfactory. That is the mildest possible way of stating the case, for there is abundant evidence that the development of the system and the quality of the service lag far behind the standards maintained in other countries.

But apart altogether from the technical aspect of the question, the baneful influence of the official attitude towards the public has manifested itself in various ways; the idea that a public service is essentially intended for the benefit and convenience of the public never seems to penetrate the understanding of the bureaucrat, or of his subordinates, who collectively regard the matter as *their* business, and, as was evident in the recent agitation of the postal servants, the profits as *their* profits. Hence there is always a tendency for the officials to assume a hectoring, domineering attitude towards individual members of the community whose views may differ from their own, and to regard themselves as Government officials rather than servants of the public—their true function.

This attitude is well exemplified in the clause in the telephone agreements which, above all, has pressed most hardly on users of the telephone—the clause which compels the subscriber to commend his very soul to the care of the department, and renders it impossible for him to obtain common justice and equity in the Courts. The iniquity of this clause has been frequently the subject of severe and outspoken comments by the judges before whom cases have been brought, and who have found themselves compelled, in direct defiance of the principles of justice, to decide in favour of the Post Office. So long as this condition prevails, the telephone service is not a service, but a tyranny, for no other word adequately describes a state of things in which a citizen is deprived of his legal remedy for wrongful treatment. It is an established principle of the British Constitution that for every wrong there is a right—why should the Post Office be empowered to override this great principle?

A correspondent of the *Times* recently suggested arbitration as a solution of the difficulty. He pointed out that appeals between the Post Office and friendly societies now come before the Registrar of Friendly Societies, upon whom powers of arbitration were conferred by an Act of 1876. The tribunal thus created, he says, has proved to be one of the cheapest and most expeditious in the country, and he sees no reason why the arbitrator, who now adjudicates in one branch of Post Office work, should not also deal with another.

Whether the same arbitrator do the work, or another be appointed to deal with telephone disputes, is immaterial; the important thing is that the present state of affairs is oppressive and intolerable, and a way ought to be found to remove the legal disability at present imposed by force upon all telephone subscribers.

A new instance of encroachment by the Telephone Department upon the rights of subscribers is brought into the light by another correspondent of our contemporary, who states that the department will not now issue two free copies of the telephone directory to a subscriber who rents an extension as well as a main instrument, unless he is on the "message-rate" tariff. This amounts to charging an extra half-crown a year for the use of an extension. If the rates are to be revised—and we understand that a new tariff is approaching completion—let them be revised systematically and *en bloc*; the policy of pinpricks is a most irritating method of procedure.

Lead.

A very active market has been witnessed for lead within the past few weeks, and the situation, while gaining in strength to a notable degree, has, to a considerable extent, regained some of the interesting features of last year. The bears who sold so heavily in December when prices slumped heavily (the average for the month being only £17 8s. 8d. a ton, against £19 9s. 5d. in November, and £19 14s. 10d. a ton in October) were driven in a half panic to cover, and prices accordingly soared upwards to well over £20 a ton for January shipments, while parcels available for prompt delivery rose to an even higher figure. There was no mistaking the liberties which had been taken with the position, and the Convention, while for a time assuming the *rôle* of mere on-lookers, at last came in and bought a little, which added to the feelings of apprehension. Later on, however, the Convention reversed their tactics, and the price having been forced to an elevated figure, they came forward as sellers on a liberal scale of January shipment, nobody else, in fact, having anything to dispose of. The leading interests met the demand quite liberally at round £20 5s. for this position, and the private transactions in all probability exceeded in volume those put through publicly.

The strong impression is that the price of the metal was raised unduly under the heavy speculative buying witnessed, for there is not any real scarcity of lead even though the quantities coming forward are ample to meet the *bonâ fide* requirements of consumers. The industrial prospects for the near future, although not bad, are not calculated to inspire confidence in very much higher prices. For one thing the building trade here is not at all good, and the labour position generally is, indeed, most disconcerting. On the other hand, there is a considerable bear account.

There has not been so much doing for the export markets, though a few weeks ago the demand for Russia was of a most pronounced character, and the home buying has lately also shown a marked contraction. The advices coming to hand from the Continent are not reassuring, for German conditions are very far from being satisfactory, with a marked slackening of industrial activity in the electrical plants. The immediate position as regards prices will probably, however, be affected very largely by what happens in respect to the present oversold account. The trade as a whole does not yet believe in the stability of prices round £20 a ton, and is inclined to anticipate a falling away based upon the assumed relaxation of consumption, and the fact that, despite the Mexican position, there appears to be sufficient lead to go round, but the oversold account for the early spring months remains of considerable extent, and this will have to be reckoned with sooner or later. The statistical position is sound enough actually, the only thing being that prices are regarded as high.

The total imports for 1913 amounted to 204,136 tons, compared with 205,375 tons in 1912, and 213,704 tons in 1911. The position was thus not materially altered on the year, and it is rather surprising, after all that has been said as to the falling off in the Mexican production, to note that the imports from there were 10,380 tons, compared with 17,757 tons in 1912, and 20,219 tons in 1911. A survey of the British imports for the past 30 years shows that they have risen from 109,016 tons in 1884 to 204,136 tons in 1912. The year of the largest import was 1904, when the total was 246,506 tons, and the average price for the year £11 19s. 8d. a ton. The highest average annual price during recent years was £19 1s. 9d. in 1907, when the imports were practically identical with those of 1913.

A LOCOMOTIVE SLEWING CRANE WITH ACCUMULATOR OPERATION.

[BY OUR BERLIN CORRESPONDENT.]

THE locomotive slewing crane recently constructed by Messrs. L. von Roll'sche Eisenwerke, of Berne, Switzerland, had to comply with the following conditions: It had to travel within the factory yards of the Schweizerische Wagonfabrik Schlieren, Ltd., on standard gauge tracks, negotiating curves and switches; its dimensions had not to exceed the standard clear profile and had to be designed for the crane to pass through factory gates 4.30 m. in clear height. Its radius in the rear was limited by platforms to be passed by the crane; the maximum carrying capacity with 6 m. mean radius was fixed at 5 tons, though 6 tons had to be lifted with a smaller radius. Apart from dealing with piece goods, the operation of a grab for coal loading had to be provided for. The crane was also to serve from time to time in shunting and in hauling railway wagons from the near-by railway station to the premises of the above company.

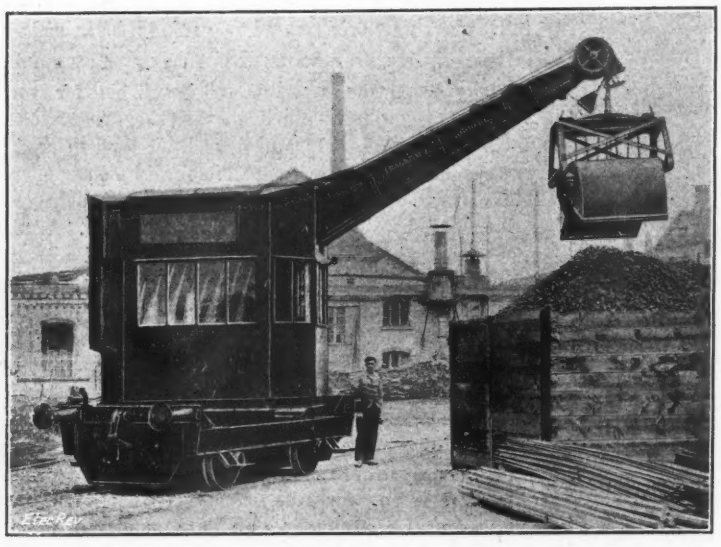


FIG. 1.—LOCOMOTIVE BATTERY CRANE.

The crane, as illustrated in fig. 1, has been designed as a slewing pillar crane with adjustable radius. The jib, as well as its hammer-shaped supporting framework, is of the plate girder type. This arrangement ensures for the crane operator a free view of the surroundings, while affording a convenient space for arranging the accumulator battery on the top, at the side of the beams. A massive counterweight had to be provided in order to ensure the stability of the crane, any use of the battery as counterweight being out of the question, because of the limited radius at the back of the crane.

On account of the considerable length of track to be travelled through, as well as of the switches and curves, accumulator operation was found preferable to the overhead supplies of electrical energy. The battery was calculated for half the average daily output, its capacity being 185 amp.-hours with a 5 hours' discharge, using 80 cells; the output is about 30 kw.-hours. The battery is charged in two groups, each of 40 cells, at an initial pressure of about 80 to 85 volts, rising to 105 to 110 volts, towards the end of the charging process. During operation the two groups of cells are connected up in series, thus rendering available a discharge pressure of 160 to 170 volts.

All motors are designed with series field windings, the outputs in lifting loads of 5 tons being 17 H.P., in slewing 4.5 H.P., and in travelling 2 by 12.5 = 25 H.P. The lifting speed is 10 m. per minute, the slewing speed 1 metre per second, and the travelling speed 2 metres per second.

The lifting gear is a cable winch with worm drive, spur gear transmission and electromagnetic brake, and is switched out in the position of maximum lift by means of an adjustable segment stop. The slewing gear comprises a horizontal worm drive provided with a sliding clutch, as a safeguard against any overload on the driving gear wheels in the event of jamming of the load or if the jib should stick fast. Two motors, each of 12.5 H.P., have been used in the travelling gear, each of which drives a shaft through a tootned wheel transmission; on account of the differences in travelling resistance of the shafts, in accordance with the position of the jib, a compensation of power effects has, however, been ensured between the two axles by a bevel wheel gear. Control is effected exclusively by means of controllers from the driver's stand on the rotary platform. The lifting and slewing controllers are operated simultaneously by means of combined

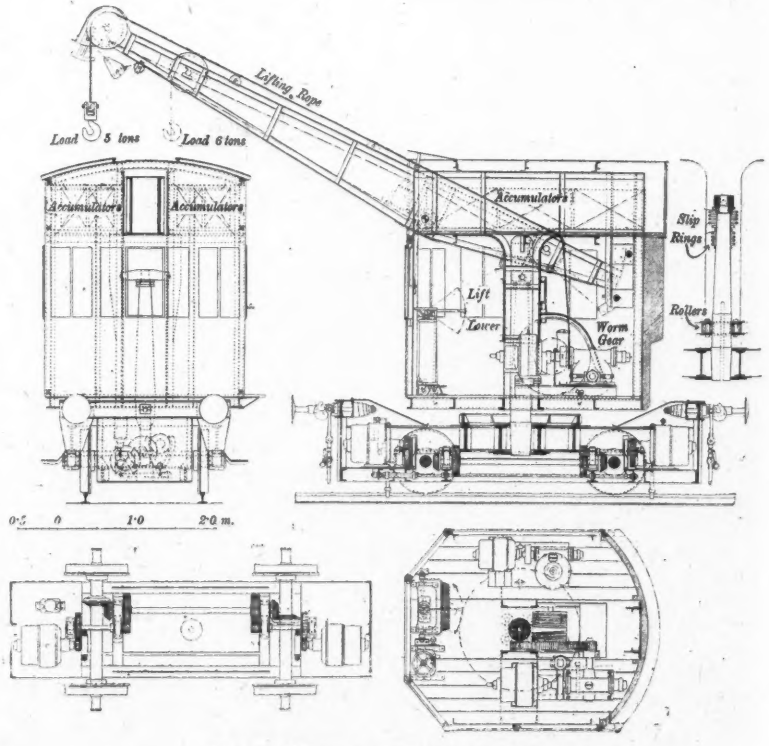


FIG. 2.—DETAILS OF BATTERY CRANE.

lever controllers through a single lever. The slewing controller is a simple reversing controller with 5 switching positions, whereas the lifting controller includes lowering brake connections. The travelling controller comprises series-parallel reversing connections, that is to say, the two travelling motors are arranged in series in the first three contact positions and in parallel in the last two positions, the crane travelling in the former case at half and in the latter at full speed.

Self-grabbing operation is performed in the following way: The open grab is lowered down on the material; on striking it, the locking device which has kept the grab open is disengaged automatically, thus allowing the grab to be closed and lifted by means of the lifting winch. In the highest position a fork is, by means of a cable, operated from the driver's stand, slipped below a bolt head of the grab, thus serving as a rest to the grab frame, disengaging the shovels and allowing them to open. In their open position the shovels are locked fast, thus allowing the fork to be withdrawn after a short litt. after which the same operation may be begun over again.

Lifting and lowering of the jib is effected by means of the lifting winch. Lowering can be effected under current, using the controller; the jib or load can also be lowered without the aid of the controller, the electromagnetic brake being lifted by hand and the load being allowed to slide under the control of the brake.

The crane above described has given every satisfaction in connection with its very varied duties.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The London Electrical Trades Dispute.

As an electrical manufacturer, I, in common with, I presume, all (at any rate, London) manufacturers, have received a letter and booklet from the Electrical Trades Union. In the letter they say that as the masters, through their Association, refuse to meet them to discuss wage rates, &c., unconditionally, they have taken the bull by the horns and issued a booklet of their demands. I do not propose to deal with the masters' so-called refusal to meet the men, beyond saying that, as far as I have heard, their only stipulation was that the rights of non-union men should be recognised, and to this the Union would not agree. No doubt this will be dealt with in your paper by some who know more about it, as I am not a member of the above-mentioned Association.

The particular points I should like to raise are with regard to the book of rules issued by the Electrical Trades Union. If the officials had for their sole object the dismissal of all their members, they could hardly have drawn up rules better calculated to accomplish that end, and the following are a few extracts:—

Rule 2.—A 50-hour week.

Rule 5.—Rates of wages: Electric fitter, 11d. per hour; armature winder, 11d. per hour; cable joiner, 11d. per hour; plumber's joiner, 1s. per hour; joiner's mate, 8½d. per hour; meter fixers, £2 per week; coil and magnet winders, 9½d. per hour.

These wages are, as everyone knows, a very considerable advance, and in some cases are obviously absurd. For instance, you will notice that no distinction is made between the rate for winding large and small armatures, whereas of course it would be absolutely impossible to pay 11d. per hour for winding a small armature; and, in fact, this rate would kill the trade in all machines under about 30 H.P.

Again, the rate demanded for coil and magnet winders is 9½d. per hour; now, winding coils, at any rate for small sizes, is the simplest possible job, and a boy at 7s. 6d. per week, after being shown for a couple of days, can do it as well as a man. Yet if these rules are allowed to stand, some of the boroughs will stipulate that machines supplied to their orders are to be made by men who are paid Trade Union wages. I should like the views of your readers, as I fail to see how it is to be done.

Now to turn to the still more ridiculous rules. No. 6 reads:—"Inside workers shall be allowed walking time for any distance under one mile, and not less than 1s. per day for over one mile and under three miles from shop. Not less than 1s. 6d. per day outdoor money be paid, and travelling time and third-class ordinary railway fares allowed for any distance over three miles and under 12 miles from shop."

Now I quite fail to see the fairness of demanding 1s. to 1s. 6d., because a man chooses, for reasons of his own, to live at a distance from his work; or, again, is it fair on the men every time they change employment to have to move their home owing to the masters refusing (perfectly rightly, I think) to pay a man extra because he lives at a distance?

No. 7.—All members working on any dirty job must receive not less than 1s. per day extra. All members working on any dangerous jobs must receive 2s. 6d. per day in addition to outdoor money.

Finally, I am afraid that if the Electrical Trades Union cannot see how unreasonable many of these rules are they will find that their members, instead of getting assistance from the Union, will find that their membership is a bar to getting a job.

An Employer.

Capping Wood Casing.

In November, 1913, a letter was kindly placed in your paper requesting readers to give us their opinion whether casings would be more satisfactory if the edges were thicker to take a screw, with the centre fillet proportionately less than is usual at present.

We have had numerous replies, and the general opinion appears to be in favour of having the three fillets of equal thickness so that the capping can be screwed on the two edges of the casings, still leaving the fillet in the centre of sufficient size with care to put a screw through, to screw the casing also on to the grounds to which it has to be fixed.

Would any of your readers express further opinions on this point? We, as manufacturers, wish to make this material to suit general requirements, and intend to alter our standard pattern very shortly with the outside edges and the centre of equal size unless many expressions of opinion are to the contrary.

C. Jennings & Co.

Bristol, *January 23rd*, 1914.

The Present Discontent.

I am glad to see by your "Correspondence" columns that central-station engineers are at last awaking to the fact that it is not *infra dig.* to be a Trade Unionist, and as a central-station man and an official of another Union, I wish the A.E.S.E. every success, and hope all station men will become members.

I should certainly advise "Omen" to join, as if he has the Trade Union spirit he will, just to help his more unfortunate brethren, though he has not much cause for complaint; if he has to work on Bank Holidays he gets his fortnight in summer, and pay if sick. Also, are not all station men on duty all the eight hours, and seven days per week? I should like him to try a works power station for a year (if he could stick it so long); no holidays; 24 hours for the longest week-end off; no sick pay; time for relief strict—if late lose shift and pay; not allowed to change shift; and not on *staff* at all.

I quite sympathise with "Idoneus Homo" in the

assistants he is supplied with, but, personally, I would rather have this type than the snob who takes a central-station job for a hobby and works for nothing. No wonder charge engineers get such magnificent remuneration!

The one point where the education of the average station engineer is incomplete is that a driver or stoker or cleaner is every bit as good a "man" in his respective position as the "shift," as "A man's a man for a' that."

If station engineers do not come off the pedestal and join a Union they are likely to get even less than they have at present, and they must not be afraid that if all the station employés are members of the same Union, they will lose caste.

It's an old saying but a true one: "United we stand, divided we fall."

Therefore, join the A.E.S.E. and do your bit to help others and yourself.

Ex-L.C.C.T.

I agree with "An Ayrshire Man" in most of his remarks, but he should have had better taste than to sneer at an Association of which he evidently has very little knowledge, promoted by well-educated electrical station engineers at considerable trouble and a certain amount of abuse, with the object of bettering the conditions under which "An Ayrshire Man" and other engineers are employed. With his aid and that of other engineers, it may be possible to rid our profession of the uninterested variety of which he writes.

There seems to be a great deal of misunderstanding with regard to the necessary qualifications for membership of the A.E.S.E. A considerable number of engineers are under the impression that wiremen, drivers, cleaners, &c., are eligible for membership. This is absurd. Not a single wireman, driver, or cleaner is, or can be, a member of the A.E.S.E. While there may be one or two members who can only by a very great stretch of imagination be termed qualified station engineers, the Committee have, to the best of their ability, scrutinised all applications thoroughly, and refused admission to all whom they considered unqualified.

When it is remembered that over 200 members of the A.E.S.E. are also on the I.E.E. list of Members, Associate Members and Students, it will be readily seen that station engineers have an association to be proud of. I think I am right in stating that the majority of the A.E.S.E. members are either chief assistants or assistant engineers, and it is particularly to these two grades that I appeal for support of this Association, because it is only by the co-operation of all highly qualified engineers that such an Association can be kept at a high standard.

It should be made clear that the A.E.S.E. is a professional association (similar to the B.M.A.) for bringing together station engineers in order that they may debate on educational and social topics concerning stations, consider differences between their members and those above them, with the object of conciliation, and generally consider methods for raising the status of station engineers.

Agitators will receive no encouragement from the A.E.S.E., and they are respectfully asked to give it a wide berth.

An Assistant Engineer and Member of the Executive.

The unjust references contained in the latter portion of your correspondent's letter under the above heading will be resented by all marine engineers engaged in the electrical profession.

The lot of a marine engineer is admittedly no sinecure, but the present-day conditions do not warrant a man leaving a profession where he can command anything from £8 to £18 per month (chiefs excluded) plus board and lodging—a by no means inconsiderable item in a large line—in order to remain ashore for 25s. to 30s. per week, as your correspondent suggests.

If such is the case, then the marine man has a definite object in view, and should his ambitions not be realised, he will not be content to remain very long on the 30s. per week scale, but will readily resume his more lucrative duties.

The marine man is *not* the type of man to lower the status of the engineering profession.

The "fed-up" expression is equally applicable to a great many central and sub-station men—who would probably be only too eager to exchange places with their much-maligned, but none the less useful, seafaring brothers—but who, through either not possessing the necessary qualifications, or being unwilling to face the hard work essential to obtaining those qualifications, prefer to remain as they are, bewailing their lot and casting aspersions upon their more energetic and ambitious colleagues.

The other acquaintances of the "Ayrshire Man" alluded to in the former part of his letter are presumably men who, having discovered their inability to succeed in the electrical profession, utilise their employer's time in endeavouring to cultivate some dormant talent, hoping thereby to secure a more congenial occupation, possibly upon the sands, aided by their beloved banjos, supplemented with straw hats and blackened faces.

W. E. Plowman.

London, *January 26th*, 1914.

Protection or Tyranny?

When I penned my previous letter to you on this subject, I never imagined for a moment that the B.E.A.M.A. would provide such a striking vindication of my criticism of their attitude, as was the case at their recent annual dinner.

Seeing a long procession of contracts going abroad, such as Aberdeen, Marylebone, Newport, York, Stepney, Sunderland, and others, to be followed by the one from Bradford, was evidently too much for the "high and mighties," so they have recourse to a lawyer-politician from the front-bench, who directs his withering sarcasm against the opinions of our eminent and respected Bradford engineer. Mr. Roles is quite capable of taking care of himself, but I am sure all municipal engineers will join me in protesting against such methods of attack. The front-bencher, however, provides us with an exact simile in his attitude over the "Ulster Question." He objects to an unjust and repressive measure, and the war cry of his comrades is: "We will fight." That is exactly the position of those who are protesting against the B.E.A.M.A. conditions. The fight is only beginning, and our friends the enemy are already resorting to the heaviest artillery at their disposal; but we are not afraid, and will not be stampeded into a panic, rather shall we gain strength and addition to our ranks.

One word in conclusion: if those who fondly sigh for an alteration in our system of taxation only realised it, they would see that the present methods of the B.E.A.M.A. will prove the strongest weapons in the hands of those opposing any alteration. If the treatment we are now receiving is the best under existing (and so-called) "Free Trade," whatever will it be under "Tariff Reform"?

Frederick W. Purse,
City Electrical Engineer.

Carlisle, *January 26th*, 1914.

Continuity of Supply.

Referring to the letter in your last week's issue under the heading of "Continuity of Supply," I fail to see the reason for the remarks relating to the Wakefield electricity department. An examination of the advertisement columns of the ELECTRICAL REVIEW for the past six months seems to prove that the payment of charge engineers in the Wakefield Corporation electricity works, namely, 35s., rising to 42s., per week is a very fair average for works even much larger than the Wakefield one. In addition to the above, relief is given in the event of sickness and on Sunday work, so that the position of a charge engineer at Wakefield is not, by any means, so hopeless a one as your correspondent endeavours to show. With regard to his further remarks, I think again that his knowledge of facts is decidedly wanting.

H. A. Nevill.

Wakefield Electricity Department,
January 26th, 1914.

[See also our "Notes" columns.—EDS. ELEC. REV.]

The Position of Electrical Railway Staffs.

My earnest advice to "Omen," "Idoneus Homo" and their colleagues is to become members of the A.E.S.E. without delay.

Although I advise this action, I cannot promise them any immediate betterment in their conditions. With such a young Association as the A.E.S.E., which has been formed with the object of improving the status of its members without sacrificing the dignity of their position and profession, any drastic action which a Trade Union (such as the N.U.R.) might take is not possible.

It must be clearly understood that the officials of the A.E.S.E. do not intend to sacrifice the dignity of their profession in any manner whatever, and are confident that by the co-operation of all station engineers a very great improvement can be made in their status without this sacrifice.

To join the N.U.R. would be slow suicide for electrical engineers, as they would be placed on the same plane as the ordinary railwayman, and have to abide by whatever decision the railwaymen as a body (station engineers would be in the small minority) might come to. The immediate result might be better than if he were a member of the A.E.S.E., but the lasting result as an A.E.S.E. member would be very much better, both in regard to remuneration and social status.

A Member of the Executive (A.E.S.E.).

The Half-Watt Lamp.

With reference to the paragraph in your editorial notes appearing on page 83 of your issue of the 16th inst., we are afraid we cannot agree with you that the half-watt lamp "will exert immense influence on the future of street lighting," except, perhaps, in some of the unimportant thoroughfares, for its efficiency falls too far short of that of the flame arc lamp, and if "no attention when it is once installed" be paid to the cleaning of the lamp, and/or its enclosing globe, the comparison will be even more marked.

We do not agree with you either, for it is far from the fact, that for all-night burning the renewals, &c., of the half-watt lamp will cost about the same as the trimming, attendance, and depreciation of the flame arc. Again, at even 1d. per unit, the cost for energy, light for light, of an efficient magazine flame arc lamp will *not* be "the same for both," but considerably less per annum, as may be easily calculated.

We welcome the advent of the half-watt lamp for, no doubt, it will be a factor in competition with the best and latest method of high-pressure gas lighting, and it will have its uses, but as a competitor of the magazine flame arc lamp for main thoroughfares, &c., except where really efficient lighting is not the great consideration, the arc lamp manufacturers need have no fear.

In conclusion, we would say we think your article was penned without due consideration of the various factors that make for efficient and economical street lighting.

per pro. **Oliver Arc Lamp, Ltd.**
Wm. D. Pell, *Director*

Woolwich, *January 23rd*, 1914.

[We certainly thought we had held the balance fairly in our brief comparison of the relative merits of the flame arc and the half-watt lamp, and regret that our correspondents feel that we have not done justice to the former. As regards the probable influence of the new lamp on the future of street lighting, we did not advocate its use for main thoroughfares, but remarked that it could "be advantageously employed in streets where the flame arc would be too large a unit"; we may point out, as a practical case, that the lighting of 13 miles of streets in the borough of Holborn was carried out with one-watt tungsten lamp units of the following sizes:—20 of 1,800 c.p. (= 3 × 600 c.p.), at 30 yd.; 212 of 400 c.p., at 15 yd.; 717 of 90 c.p.; 5 of 600 and 4 of 200 c.p. (Elec. Rev., October 25th, 1912).

The largest size of lamp used was 600 c.p. Disregarding the streets lighted with 90-c.p. units as outside the question, over 2 miles of streets were lighted with tungsten lamps of high candle-power, at a cost for energy and renewals which can now be reduced by more than one-third. If flame-arc lamps were not considered suitable for these streets when only the one-watt lamp was available, their chance of adoption there is obviously much less now.

Our comparison on the score of cost was based on the figures given by Mr. M. Solomon in the discussion on his paper on Yellow-Flame Arcs, in May, 1912. Taking 1,000 M.S.C.P., and allowing for the absorption of globes, for 4,000 burning hours per annum, the author gave the following data:—

Flame arc:—			
Carbons and depreciation	£4	10	0
Trimming and attendance	2	0	0
Energy at 1d. per unit	7	0	0
	£13	10	0
New tungsten lamps and depreciation to fittings	£3	16	0
Trimming and attendance	0	10	0
Energy at 1d. per unit	18	0	0
	£22	6	0
Using half-watt lamps, this figure will be reduced by £9	£13	6	0

Whether the flame arc or the half-watt lamp proves actually the cheaper at 1d. per unit depends upon the cost of renewals—that is, upon the life of the half-watt lamp, and it will be remembered that the actual recorded average life of tungsten lamps in street lighting has been several thousand hours. If this experience is repeated in the case of the half-watt lamp, as it probably will be, the comparison will not be far wrong.—Eds. Elec. Rev.]

The New Half-Watt Lamps.

With reference to Mr. Maycock's letter in to-day's issue, I am afraid that the writer has not very carefully studied the various "half-watt" lists, as in the Ediswan list before me it distinctly states: "It has an exceedingly low consumption of current, *the energy* consumed being only ·5 watt per candle-power."

C. W. Bennett, *Engineer.*

Wood Lane Works, London, W.
January 23rd, 1914.

A Correction.

Your personal reference to myself on page 148 of your issue of the 23rd inst. is incorrect in one detail. I am not on the railway staff of the British Thomson-Houston Co. I do not wish to obtain credit where I have no responsibility.

F. W. Carter.

Rugby, *January 26th*, 1914.

Central Stations by Auction.—The existence of the Akkumulatoren und Elektrizitatswerk vorm W. A. Boese, of Berlin, has now been practically brought to an end, after four years of difficulties, by the disposal by auction of the company's last assets at the instance of the protection association for the debenture-holders. Some time ago the Mark Electricity Works Co. acquired from the company three Pomeranian stations for £17,500, although the transfer carried with it the acceptance of various liabilities of the stations. On the present occasion, however, and in order to satisfy debentures for only £450, the shares held by the Boese company in no fewer than nine stations and controlling the latter, have been sold for the mere song of £2,500 to the Rhenish Siemens-Schuckert Works Co., which, although only requiring two of the stations, has purchased the lot in order to make certain possession of the two at Witzenhausen and Kandel respectively. The new proprietary company has also had to take over the liabilities attaching to the stations. The value of the works does not lie in the stations themselves, but in the concessions incidental to them, and having a currency of about 40 years, with the right of erecting overhead mains over the roads. It is considered that if the debenture-holders had exercised greater patience and had abstained from drastic action as in the past four years, the stations might have been disposed of at a future period on considerably better terms than have been obtained by forcing the sale.

THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION.

We have been favoured with the following summary of the report of the Council for the year 1913:—The Council submitted the certified income and expenditure account and balance-sheet for the financial year ending September 30th, 1913 (which were adopted).

The Council were of the opinion that any general statement which might be made as to the progress of the Association at the eighth year since its incorporation, and the second year of working under its new constitution, might be made quite frankly in terms of congratulation. The position of the Association had, during the year just concluded, been established beyond question, the membership had again substantially increased; and keen activity was indicated by the fact that the number of Sectional and Committee meetings held during the year was 185, an increase of 50 over the number held during 1912, all of them being commendably well attended.

The Council recalled that the report for 1912 named the subject of the standardisation of a complete set of general conditions of contract, as between manufacturer and purchaser of heavy plant, as of first-rate importance, and looked forward to early agreement on this subject between the Association and the Institution of Electrical Engineers. The Institution had recently referred the matter back for the advice of counsel, whose opinion had now been received; and, though experience showed that prophecy in this connection was hazardous, it was believed that the Institution would now use little time in coming to a decision.

Scarcely less important than the foregoing was the subject of standardising the conditions of sale which governed those smaller commercial and industrial transactions in which a large majority of members were engaged. The Revising Committee had now produced, and, under the Council's direction, put into circulation, two complete sets of conditions of sale with a legal and business commentary clearly explaining their use and importance.

The excellent system of tendering embodied in the agreements known as Cross-Tendering Agreements had won further adherents during the year, and there were now in operation the following such agreements: (1) Steam-engine builders and dynamo makers; (2) Diesel-engine builders and dynamo makers; (3) Condenser makers, turbine builders, and steam-engine builders; while a fourth, between gas-engine builders and dynamo makers, awaited the consent of certain gas engine firms before going into operation.

Leaving the purely business and legal sides of the internal work of the Association, satisfactory progress was reported on the scientific side of standardisation. The Committee dealing with the revision of standards for electrical machinery had completed and printed a set of Rules entitled "Standardisation Rules for Electrical Machinery," and, pending further action by the Engineering Standards Committee, these had been put into circulation and were being used as a reference handbook in connection with the general standardisation of types and performance of machines as well as between buyer and seller. Further technical recommendations had been prepared upon several important subjects dealing with the performance of standard machines, and other sections were in hand. The Standards Committee's representation at the Zurich and Berlin meetings of the International Electrotechnical Commission had been of great assistance in obtaining full consideration for manufacturing interests, and was now co-operating closely with the Engineering Standards Committee and the Standardisation Committee of the United States of America in connection with the preparation of new international rules. The Engineering Standards Committee had invited the co-operation of the Association in the work of revising Report No. 37, dealing with consumers' electric supply meters, and two members had been appointed to serve. The Committee for the standardisation of accessories had been actively engaged during the year, and had produced and transmitted to the Engineering Standards Committee specifications for two and three-plate ceiling roses, which were receiving the favourable consideration of the panel of that body. A further draft specification for one of the sizes of wall sockets and plugs in most general use would shortly be put forward. The Committee for the standardisation of radiator lampholders and plugs for cooking apparatus had made progress, but a report was not yet available. A Committee of the Switchgear Section had given attention to the subject of electrical symbols as a basis for further standardisation, and produced a set of prints, which had been circularised to members, and had met with general acceptance. The same section had also to its credit the provisional settlement of many differences which previously existed as between manufacturers and purchasers and the Home Office inspectors, which resulted in mistakes and misunderstandings, the cost of rectifying which usually fell upon members. With a view to removing all doubt as to what the present factory regulations really call for, this section had sent two deputations to Mr. G. Scott Ram, H.M. Electrical Inspector of Factories. The result was that a settlement of all difficulties to date had been obtained, and a full report would shortly be circularised.

No fresh legislation proposed or introduced during the last part of the Parliamentary Session had appeared to call for action. The Council had opened negotiations with the Commercial Intelligence Department of the Board of Trade with the object of securing that the method of analysis and summary at present adopted in the annual statement of the trade of the United Kingdom with foreign countries, issued by the Board should afford segregated figures, for imports and exports, in the many branches of the electrical industry now grouped. Deputations of the Association which met the railway managers at the Railway Clearing House and elsewhere in respect of the classification of electric heating stoves, had been successful in obtaining redress of grievances, and, the sanction of the Board of Trade having been obtained, the new classification would be circulated as soon as the railway managers had notified a date upon which it would go into force. A deputation in respect of the railway classification of switchgear had obtained certain concessions which were considered inadequate, and the matter was being carried further.

An agreement was looked forward to between the Electrical Contractors' Association and the sections of the Association immediately concerned.

The Council expressed the hope that within a reasonable time further progress could be reported in respect of the removal of handicaps to members' trade in Canada, the matter having been referred for expert opinion.

The Council had passed resolutions strongly recommending intertrading between members of the Association, and these had, as far as information was available, been well supported. Detailed arrangements giving effect to these resolutions were under discussion by the various sections.

Standing Rule No. 2, which prohibited members from exhibiting at exhibitions not patronised by the Association had practically controlled all promotions attempted during the year, and the rule apparently met with the unanimous approval of members.

The subject of the Association's patronage of municipal exhibitions had been placed on a definite footing by the creation of a Joint Committee of the Municipal Electrical Association and the Association.

An application had been received during the year for contributions of plant and apparatus towards the equipment of the laboratory of the youngest University in the Empire, that of Hong Kong. Investigation had showed that, by acceding to the application, British manufacturers would be placed in a position of commercial advantage in that portion of the globe. Inquiries made through the Foreign Office showed that the University was properly constituted and had a satisfactory endowment. The opinion of the President, Lord Ampthill, had then been taken on the whole subject and, as a result, it was decided to invite members to make a gift to the University of a completely equipped electrical laboratory, containing every sort of plant and apparatus which the Faculty of Engineering deemed to be necessary. The response of members to the call made upon them had been generous, and this laboratory would, before long, be completely equipped with plant and apparatus of entirely British manufacture. The thanks of the Council were, in particular, due to Mr. A. H. Preece, of Messrs. Preece, Cardew & Snell, consulting engineers to the University, for the great pains to which he had gone in arranging details and for his indispensable assistance in bringing that large undertaking to a satisfactory issue. At the special request of the governing body, and by permission of the President, the electrical laboratory of Hong Kong University was called "The Ampthill Laboratory," and its walls bore a brass inscription setting fourth the source of the gift.

The number of members on the register at the beginning of the year was 125, being an increase of 16 on the number on the register as recorded in the last annual report.

Under Article 17 of the Articles of Association, five members of the Council retired as from the date of the annual general meeting and, being eligible, offered themselves for re-election (and were unanimously re-elected) as follows:—

Ferranti, Ltd. (A. Bruce Anderson).
British Thomson-Houston Co., Ltd. (H. C. Levis).
General Electric Co., Ltd. (M. J. Railing).
Dick, Kerr & Co., Ltd. (W. Rutherford).
Elliott Bros. (W. O. Smith).

Messrs. Price, Waterhouse & Co., the auditors of the Association, retired under Article 53, and, being eligible, offered themselves for re-election (and were unanimously re-elected).

ANNUAL DINNER.

On January 21st the annual dinner of the Association was held at the Savoy Hotel, the Right Hon. Lord Ampthill, G.C.S.I., President, being in the chair. Amongst the guests were Lord George Hamilton, Mr. F. E. Smith, M.P., Sir J. W. Taverner, Mr. W. Duddell, Mr. J. McD. Henderson, M.P., Dr. Glazebrook, Mr. Faithful Begg, Dr. W. C. Unwin, Dr. H. F. Parshall, Mr. Samuel Insull, Mr. J. A. Bryce, M.P., and Sir J. McCall, as well as many eminent engineers, and some 420 covers were laid.

After the loyal toasts, Mr. A. Bruce Anderson, chairman of the Council, proposed "Our Guests," remarking that the dinner was held primarily for the purpose of inviting them. The main object of the Association, he said, was to ensure for its members conditions under which they could attain the maximum efficiency—an object to be desired by everyone, but agreement with other responsible sections of the industry was not likely to be attained if individuals acted upon independent lines. They were all interested in the extended use of electricity, which meant increased output of plant and machinery; their combined interests should outweigh any sectional differences that might exist, and he was certain that in time all would unite for the same ends. If the electrical industry were to undertake a national propaganda after the style of the gas industry, the municipal authorities ought to be amongst the first to put their hands in their pockets; but they were hampered by legislative restrictions, and it was the intention of the manufacturers to assist them to remove those restrictions.

The manufacturers would also be called upon to bear their share in such a national propaganda, but what guarantee had they that the resulting orders would be placed with members of the Association, or even in this country? The Association would do good work in driving home the fact that if a man, by buying abroad, injured those from whom, later on, he would want assistance, he would be embarking upon a suicidal policy, and destroying the market upon which they all subsisted. No one in this land could afford to regard without grave concern conditions which were prejudicial to the welfare of the British manufacturer; what was good for the manufacturer was good for the country, and by doing their best to consolidate the electrical industry, they were doing their best to advance the interests of the Empire.

Responding for the guests, Mr. F. E. Smith said Mr. Anderson had spoken of the importance of keeping work in England and not sending contracts abroad; but those were most elementary fallacies—they had been told so by the highest authorities; if a big order went to Germany, then Germany must necessarily buy something from England. He had read that day that Bradford Corporation was going to buy a German turbine at a cost of £10,000; several British tenders were lower, but the German plant was so much superior to the British that the Corporation had to accept the German tender. They might suppose that it was unfair to them to send the order abroad, because they had to bear a heavier burden of taxation than the manufacturer in any other country, and that the order ought to have gone to those who supported this country and helped to build Dreadnoughts to defend it, rather than to those who were building Dreadnoughts to destroy this country. But although it was true that this contract had been lost to a British firm, they had forgotten that Germany might buy something from other British manufacturers, or some of our raw material which, when developed in Germany, might return to this country. He used to think that that manufacturer had an advantage who had the largest market with security and without restrictions, and could undersell one who supplied a less open market. The German manufacturer had free trade throughout the German Empire, and also in these islands; the English manufacturer had free trade in this country (except Bradford) but not in Germany; thus we had secured a considerable free trade market—for our competitors. If we had started *de novo* at a great European congress, and our representative had come back with the statement that whatever country we sent our commodities to, they should be taxed, but whatever commodities were sent to us should come in free, we should not have had a high opinion of his intelligence. It was most regrettable that this matter had ever become a party question; no one could find a responsible body of business men who would say that the question ought to be waved aside as a party cry. The manufacturers' interests were bound up with those of the workpeople in the prosperity of the country, and if it were suggested that their interests were separated or divergent, an irreparable wrong would be done.

Mr. Duddell, also responding, spoke of the importance of broadening the field of application of electricity, and said that he particularly wished to see its uses extended in connection with agriculture. He was sure that with the aid of electricity great progress could be made on a commercial scale; the experiments already carried out had had satisfactory results. The Institution of Electrical Engineers would do its best to advance the interests of all branches of the industry.

Proposing "The Electrical and Allied Industries," Lord George Hamilton said that the object of the Association was to protect the electrical industry from attack and to promote its welfare. Two instances occurred to him illustrating the need of such an Association. In 1881 a well-intentioned Act of Parliament was passed which had the effect of practically killing electrical enterprise for seven years; the Board of Trade then found out the mistake, but in the meantime our foreign competitors had got ahead of us. The Association, had it existed then, might have prevented the error. Again, Germany and the United States saw their opportunity in China, and initiated the young Chinese engineers into their systems. But a complete set of equipment was being sent out to Hong-Kong University to acquaint the young Chinese with British methods, and would enable us to start on terms more advantageous than would have been possible without this Association. The British manufacturer could compete in quality with anyone, and where price and quality were equal, a contract should go to the Englishman; but if the quality were not right, this was not so—quality must have the preference to price.

In reply, Lord Ampthill said he thought the reason why he was made president was that the Association believed that the welfare of British industry and the national prosperity were bound up together, and politicians must be made to realise the fact. He was proud of the gift to Hong-Kong University, at a cost of £5,000—an act of patriotism to ensure that British practice should be made familiar to the Chinese; the effect would be evident in the future, when China was developed and British industry would have a fair share of the trade. In this connection special thanks were due to Messrs. Anderson and Hirst, and to Mr. Arthur Preece. British manufacturers were holding their own, but that was not enough; it would not be satisfactory until some of them were making their fortunes—for that would mean that the workpeople also were prospering from the great trade boom; that could not be so unless the profits were invested in the industry, but manufacturers were not inclined to back British industry in this way, because in this country alone foreign competition was not checked by the action of the State. The working classes were not getting a fair share of the increased national wealth; we were becoming more and more a nation of financiers, and our profits were invested abroad, so that the demand for employment was not fostered. Cobden's prophecy had not been fulfilled, and England had not become the workshop of the world; it was a matter of common-sense to change our policy as soon as possible, to suit the altered circumstances. Until the State took action they must help themselves—hence the formation of the Association; they had to make themselves heard, otherwise Parliament and the nation would take no notice of them, and much could be done by organised combination. The laws dealing with municipal trading needed bringing up to date. With regard to the *Invincible*, the Admiralty had not succeeded in making electric driving effective, though foreign nations had, and an inquiry into the circumstances was urgently needed, to run the fault to earth. He agreed with their chairman that the welfare of each and every class depended upon the welfare of British industry.

Mr. F. R. Davenport proposed "The Health of the Chairman of the evening," referring to the practical energy of the President and his efforts in connection with the Hong-Kong presentation, and Lord Ampthill briefly responded.

An excellent programme of music and song was performed during the evening.

CURRENT AT 2d. PER UNIT FROM PRIMARY CELLS.*

So early as 1838, Matteuci discovered the existence of a potential difference between two platinum plates immersed in different gases, and a year later Grove invented the gas battery which bears his name. This battery comprises two platinum plates, surfaced with spongy platinum, covered by gas containers, and dipping into dilute sulphuric acid. If one electrode be surrounded by oxygen, the other by hydrogen, and the external circuit be closed, current flows through the latter from oxygen to hydrogen. The E.M.F. of the Grove battery varies with the gases employed, the electrochemical series ranging from chlorine to hydrogen. During working certain characteristic changes appear on the surface of the electrodes, and concerning the nature and significance of these changes—and, indeed, concerning the whole nature of the action proceeding in this cell, which employs a triple contact of solid, liquid and gas—many of the most famous scientists of last century contributed more or less inconclusive data.

Grove himself entertained no high hopes as to the practical utility of his gas cell, and until recently the work of no other investigator indicated that the cell could be made of practical value. It is now reported, however (*loc. cit.*) that Dr. Karl Siegl has succeeded in developing a modified cell of from 100 to 1,000 times the capacity of the Grove cell, which is by far the most economical primary battery yet discovered.

Commencing by investigation of the seat of E.M.F. in the Grove cell, Siegl concludes that all parts of the electrodes are operative during short discharges. During longer discharges, the gases occluded in the electrodes are consumed. The portions of the electrodes surrounded by gas are fed by the latter, but the portions submerged in electrolyte not only cease to be operative, but also become polarised in opposition to the active electrode area, hence the latter should be as large as possible. This desideratum may be realised, while securing a cheap construction, by employing platinised carbon granules (of, say, 3 mm. diameter), contained together with a carbon contactor plate by a porous cell, which also forms the gas chamber, and is saturated with electrolyte. The gas pressure prevents the electrolyte from flooding the porous cell.

As the result of investigations conducted with gas batteries of this type, using chlorine, oxygen, air, carbon-dioxide, acetylene, lighting gas and hydrogen in various combinations, and with hydrochloric acid as electrolyte when using chlorine, but sulphuric acid in other cases, Siegl finds the P.D. available per cell, the gas consumption and the working cost (presumably for gas alone) to be as follows:—

GAS CONSUMPTION AND COSTS PER KW.-HOUR.

Gases used.	P.D. per cell.	Gas consumption. Cb. ft.	Cost per KW.-hr.
$Cl - H_2$	1·4 v.	10·6 H_2 + 10·6 Cl	5·0d.
$O_2 - H_2$	0·9 v.	16·2 H_2 + 8·1 O_2	4·1d.
Air $- H_2$	0·8 v.	18·4 H_2 (+ 9·2 O_2)	2·4d.
Air—lighting gas	0·7 v.	24·7 H_2 (+ 12·4 O_2)	2·0d.
$CO_2 - H_2$	0·8 v.	not measured	—
Air $- C_2 H_2$	0·3 v.	not measured	—

When using air round one electrode it is, of course, unnecessary to provide a porous cell round the latter; an electrode immersed below in electrolyte penetrates into the open air. To secure adequate upward suction, wadding is placed round the negative electrode cells.

The current taken from Siegl cells should not exceed 3·75 amperes per sq. ft. of active electrode surface on momentary discharge, 0·28 ampere per sq. ft. on longer discharges, or 0·19 ampere per sq. ft. on continuous discharge, otherwise polarisation will occur. The data in the above table assume that the cell is not polarised. Pressure variations from 1 cm. (mercury) to 8 atmos. are said to affect neither the E.M.F. nor the current output of Siegl cells.

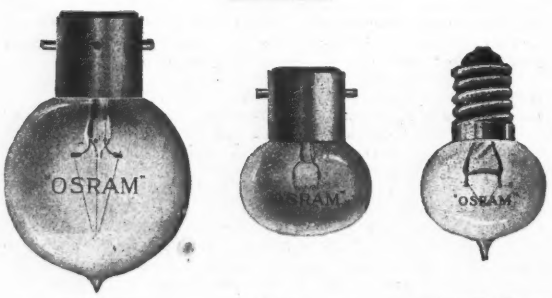
* *Elek. Zeitschrift.*

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Osram Drawn-wire Battery Lamps.

We have received from the GENERAL ELECTRIC CO., LTD., their new list of Osram drawn-wire battery type lamps, covering every possible requirement—from the tiny bulb less than ⅛-in. in diameter for medical work, up to the powerful 50-C.P. for use in automobile headlights; a number of entirely new types have been added. The size of bulbs has been reduced, and new and greatly improved types of filaments have in a number of cases superseded the earlier ones. An entirely new type of Osram headlight lamp is shown in fig. 1, in which special care has been

HEADLIGHT.



SIDELIGHT. TAIL-LIGHT. MINER'S LAMP.

FIGS. 1-4.—NEW OSRAM BATTERY LAMPS.

paid to the correct form of filament for use in parabolic reflectors. Side lamps are made with a bow filament (fig. 2), and tail lamps with horizontal spiral filaments and a pipless bulb (fig. 3). Automobile lamps for interior lighting are also listed.

A special miner's lamp, designed to comply with the regulations of the Home Office, is illustrated in fig. 4, and for sign illumination three types are listed. Special lamps for motor-bus lighting and for medical and scientific work are also available.

The "Extralight" Tariff Apparatus.

It is impossible to fix a tariff for current to give the lowest possible margin of profit equally for all consumers unless the demand of the consumer is known. If current is to be sold as cheaply as possible, it must be on some system by which the demand is measured or fixed. The current limiter in any of its numerous forms will effect the latter; but it is found in practice that the inconvenience to the consumer is too great. He can never exceed his fixed limit, although his occasionally doing so would not raise his effective maximum demand, and would be a great boon to him. The "Extralight" is a current limiter which can be put out of action by the consumer at will, and remains out for some hours; at the end of the predetermined time it automatically resumes its functions. The fixed price paid by the consumer permits him to cut out his limiter a certain fixed number of times yearly; when he has used this permission to the full, the instrument is locked, and must be reset by an official from the station.

The device as shown in the figure is extremely simple in principle. It consists of a magnetic mercury limiter with an extension of the glass tube containing extra mercury. The whole is mounted upon a disk which can be turned by the consumer, whereby the limiter is flooded with mercury and so short-circuited. The mercury is held in position by some of the gas being trapped below a porous plug which divides the tube into two parts; this gas gradually diffuses through the porous plug into the other part of the tube, and the mercury sinks again to its former level, putting the limiter into action after the lapse of some hours.

The glass tube with the porous plug is filled with an indifferent gas and hermetically sealed, and there would seem to be nothing which would make the apparatus less reliable than the ordinary mercury limiter, the reliability of which can be ensured by attention to sources of trouble during the manufacture.

It is proposed to employ the apparatus without a meter for small lighting consumers, the cost being very little more than that of the ordinary cheap limiter. For consumers who wish to use their current for all household purposes, it may be combined with a meter on a very low unit tariff; the consumer is thus enabled

FIG. 5.—THE "EXTRALIGHT" CURRENT LIMITER.

to economise as he pleases on his maximum demand, instead of being rated according to the size of his house or his installation, while at the same time he can on special occasions exceed his demand, as it is quite fair that he should.

The inventor and patentee is Mr. H. Stafford Hatfield, of Herzogin Elisabethstrasse, Brunswick, Germany; the apparatus has been put on the market in Germany by Messrs. Schott & Genossen, of Jena, under the name "Mehrlichtbegrenzer."

Zed Fuses in Railway Work.

Electric light installations in railway stations and yards must of necessity be carried out in a manner which will obviate risk of failure of the light in the public spaces or in the signal lamps. Not only is the wiring and apparatus exposed to all sorts of weather, but there are also the menaces of steam, smoke, and heavy vibration

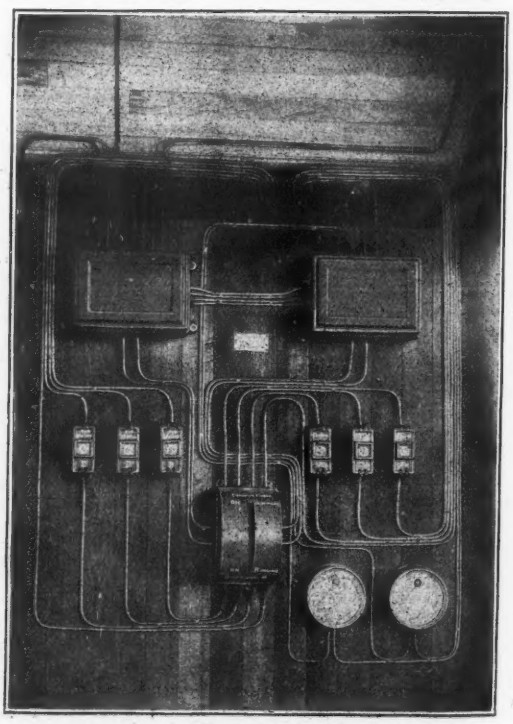


FIG. 6.—CONTROL FOR SIGNAL LIGHTING.

to be guarded against. All materials must undoubtedly be of a substantial and reliable pattern, and they must be erected in a first-class manner.

In a railway installation in Burmah, recently brought to our notice by MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Caxton House, S.W., the conditions were doubly severe, due to the tropical climate.

The new station and yard at Rangoon, Burmah, is an important passenger and goods centre, covering a space of 1¼ miles long, and 1,000 ft. wide at its greatest depth. The yard consists of engine, carriage and signal repairing and cleaning sheds. The extent of the installation and the nature of the materials used, can be judged from the following materials used :—Zed fuses, 409 ; bare copper wire, 45,820 yards ; insulated wire, 12,343 yards ; Stannos wire, 11,232 yards ; Wotan lamps, 37,525 C.P.

After operating for over 18 months, and having been subjected to the vagaries of the Eastern climate, everything appears to be as good as when first erected. No faults have been reported.

Fig. 6 shows one of the controls for the signal lighting, consisting of a main four-pole change-over switch with main Zed fuses

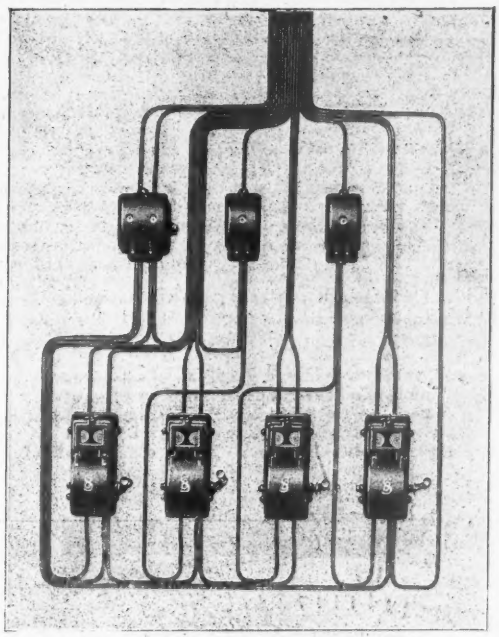


FIG. 7.—SWITCHES AND WIRING, RANGOON RAILWAY INSTALLATION.

and an ammeter on each side of the duplicate supply. The ammeters are used as lamp failure detectors, and are regularly watched by the signalman on duty.

All the Zed fuse boxes, and distribution boxes, are of a heavy cast-iron watertight pattern.

Fig. 7 shows other details of the installation.

The complete satisfaction, which has been given under particularly trying conditions, bears full testimony to the reliability, safety and convenience of Zed fuse fittings, as well as to the suitability of the other classes of material which were selected.

Igranic Rotor Starting Rheostat.

THE IGRANIC ELECTRIC CO., LTD., of 147, Queen Victoria Street, E.C., are introducing a new rotor starting rheostat. In this

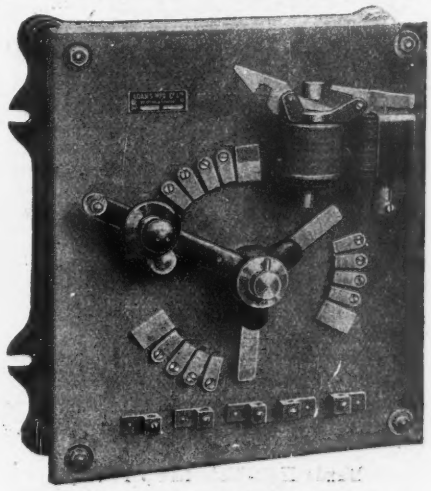


FIG. 8.—OPEN TYPE ROTOR STARTER.

the switch parts are mounted on an "Igranicised" slate base, and are not crowded at all, but designed with a generous margin as regards spacing of parts.

In the small sizes button contacts are used, while all other sizes have contacts of the renewable segmental type easily replaceable from the front. The new and special design of these contacts makes renewal easier and quicker than ever, because, although held

FIG. 9.—IRONCLAD SWITCH WITH WINDOW.

very securely in position, it is only necessary to take out one screw in order to remove a contact.

The resistances are arranged to allow approximately full-load current on the first step.

Fig. 8 shows an open-type starter with automatic no-volt and over-load releases, whilst fig. 9 shows the totally-enclosed type with glazed inspection cover.

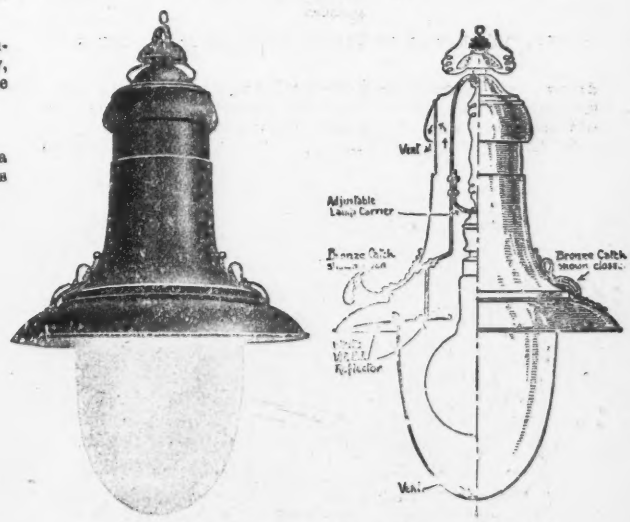
Siemens Half-watt Lamp Fitting.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., Tyssen Street N.E., send us particulars of a new lantern specially designed for use with Wotan high candle-power half-watt lamps.

Owing to the amount of heat generated at the neck of the lamp, a special scheme of ventilation is provided so that the lighting units shall be kept as cool as possible, the life of the lamp being thereby increased to a considerable extent. In addition to the special ventilating arrangements, the globe is opalescent, which satisfactorily screens the extraordinary brightness of the filament.

Our views show the construction of the lantern, and it will be observed that the Goliath Edison screw-holder is fastened to a carrier which is mounted in a slide, thus allowing a certain degree of regulation for the position of the lamp in the globe of the lantern.

The lantern itself is provided with an insulated shackle suspension, which renders it suitable for use under all conditions of



FIGS. 10 AND 11.—HALF-WATT LAMP FITTING.

weather, and this particular fitting with half-watt lamps is intended as a suitable substitute for arc lamps for any installation in which high candle-power units are used.

It will be manufactured in three sizes :—600 and 1,000-C.P. half-watt lamps, 14½ in. diameter by 24 in. long ; 1,000 and 2,000-C.P. half-watt lamps, 18 in. diameter by 28 in. long ; 2,000 to 3,000 C.P., 22½ in. by 30 in. long.

We gather that an actual test of these lamps proves that the ventilation is exceptionally efficient ; in cases where it is necessary to use some additional protection, a wire guard is obtainable which will satisfactorily cover the globe.

R. W. Paul's Instruments.

MR. PAUL'S new catalogue, mentioned in our last issue, brings together for the first time, we believe, a complete account of his many specialities; it is issued in 11 sections, which will eventually be bound in a volume of 550 pages. We have from time to time had occasion to refer to the original and ingenious instruments and devices which he has produced, but there are many others to which we have not referred individually; some of these in the new catalogue are briefly described below.

Fig. 12 shows the "Decade" rotary bridge; the variable resistance coils are mounted in four drums, which rotate between

FIG. 12.—DECADE ROTARY BRIDGE.

laminated brush connections, so that as the drum is rotated it brings the coils into circuit successively. The resistance is read off as a straight line of figures, and the risk of error is minimised, while the speed of working is increased. Fig. 13 shows one of the

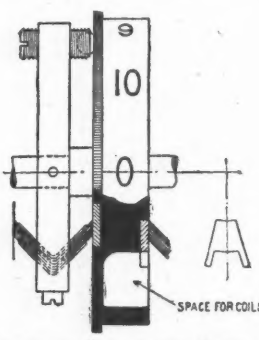


FIG. 13.—DETAIL OF RESISTANCE DRUM AND BRUSHES.

drums partly in section, with the brushes at the lower side, and a simple ball-click above to define the contact position. The total contact resistance per dial is only 0·002 ω, and is constant.

A complete section (C) is devoted to the numerous modifications

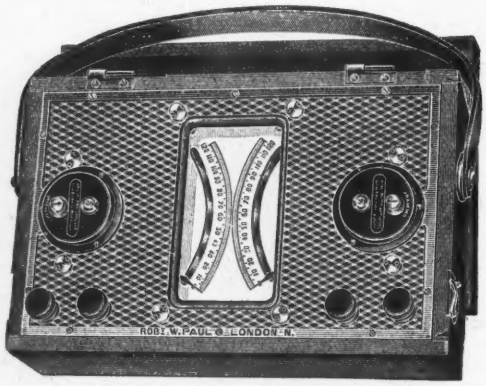


FIG. 14.—TWIN UNIPIVOT PATTERN L L.

of the "Unipivot" galvanometer, which forms so important a feature of Mr. Paul's inventions. We hardly need remind our readers that the essence of this device is a circular coil pivoted at its exact centre, and, in the case of D.C. instruments, surrounding a sphere of soft iron. The movement is extremely sensitive and robust, and needs no levelling; hence it has been adopted for a great variety of purposes. Fig. 14 shows it in the form of a "Twin unipivot," a combined voltmeter and ammeter of any desired ranges, from millivolts to (with shunts) kiloamperes. A novel application of the Unipivot instrument is to central station or lecture-room purposes, by projecting the image of the scale and pointer upon a screen half a metre or more in length. Fig. 15 shows the screen, which can be suspended from the ceiling or wall at a height of 8 or 10 ft., and is clearly visible over a great distance in broad daylight. In the central station the reading would be amperes, volts or watts, but in the lecture room the device, with accessories, becomes a universal instrument. The great length of scale being obtained by optical means, the indications are as dead-beat as in the smallest instrument, and the projecting apparatus is quite simple.

Other patterns of galvanometers are also made, as well as a variety of apparatus for laboratory equipment. Last week we referred to Section S, which covers elementary College apparatus; Section E deals with a higher class of laboratory instruments, such as sensitive reflecting galvanometers, potentiometers, keys, &c. Section F is devoted to alternating-current measuring apparatus, including the Duddell-Mather standard wattmeters, for which the highest attainable degree of accuracy is claimed, even on circuits of very low power factor, for currents up to 1,000 amperes and pressures up to 75,000 volts.

The Irwin astatic dynamometers and wattmeters—also emanating from the Central Technical College—and the Sumpner iron-cored dynamometer, the Ayrton-Mather electrostatic voltmeters, &c., and the Irwin hot-wire oscillograph are other features of this section. Lastly, in Section H, apparatus is listed for measuring inductance, capacity and effective resistance up to frequencies of 2,000 cycles per second, the outcome of present-day research in telephony and radio-telegraphy. We illustrate in fig. 16 a meter which gives a quantitative reading of the amount of cross-talk between two telephonic circuits or apparatus—a matter of increasing importance, owing to the extending adoption of loading coils and superimposed circuits. To the Campbell inductance standards and bridges and vibration galvanometers, the Irwin Optiphone, &c., we can only refer.

Not only are the various instruments fully illustrated and described, but diagrams of connections and instructions for use are provided, and in effect the catalogue forms an educational work of very high merit. We congratulate Mr. Paul and his distinguished collaborators upon a very excellent production. It is interesting to note that the prices are confined to a coloured inset, the first

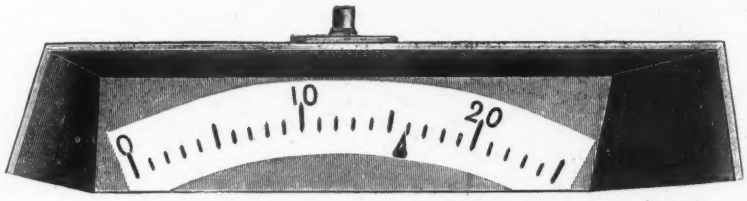


FIG. 15.—SCREEN USED FOR PROJECTING UNIPIVOT SCALE.

figure of the list number and of the page number are identical, and the initial letter of the code word designates also the section in which the description can be found. The complete catalogue

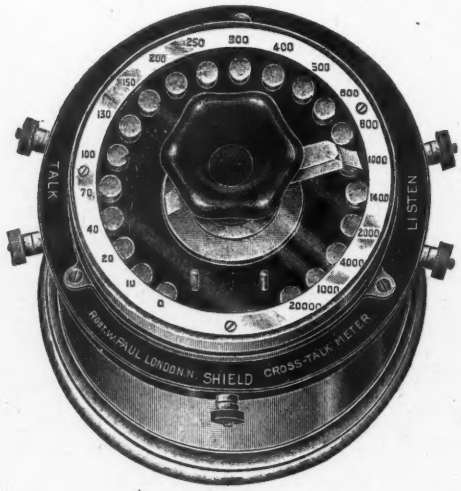


FIG. 16.—CROSS-TALK METER.

(including the sections relating to ohmmeters and pyrometers, not yet issued) contains over 2,000 entries, and about 800 illustrations and diagrams.

Mazda Half-Watt Lamp Fitting.

In their price list on Mazda half-watt lamps, published on January 12th, the B.T.H. Co. illustrated and described six special fittings and a varied selection of Goliath E.S. holders for use with the half-watt lamp.

Since then the B.T.H. Co. have put another semi-indirect half-watt fitting on the market. This fitting—the B.T.H. "Lumino," illustrated in fig. 17—has been designed to comply with the demand for an inexpensive, yet effective, semi-indirect unit, which can be used anywhere, independently of the condition, or even existence, of a ceiling. The top reflector is made of metal, with a white vitreous enamelled reflecting surface, and the under reflector

FIG. 17.—LUMINO SEMI-INDIRECT FITTING.

of opalescent glass. The fitting will take a single Mazda half-watt lamp of any size, and is supplied complete with Goliath E.S. holder. As a light distributor and diffuser it is eminently suitable for the interior lighting of shops, factories, &c. The opalescent bottom reflector employed is sufficiently dense to diffuse the light in an agreeable manner, without reducing the efficiency of the unit to any great extent.

LEGAL.

PIGGOTT *v.* NATHAN.

IN the City of London Court last week Piggott Bros. & Co., Ltd., 220, Bishopsgate, claimed £23 16s. 6d. against Mr. Henry Nathan, meat salesman, and his wife, of Stamford Hill, for supplying awnings, rout seats, chairs, carpets, electric light, &c., in connection with the entertainment which they gave to 100 friends upon the marriage of their daughter on July 24th.

Defendants counterclaimed for £20 as damages suffered through the "loss of society of wedding guests" owing to the electric light failing at 11.40 p.m. while the ball and wedding festivities were in progress on their lawn.

MR. ROSS, defendants' solicitor, said that the band was to have stayed until 3 o'clock or 4 o'clock the next morning, and that was impossible as there was no electric light.

MR. HART said that the current came from the house supply. Defendants were warned that it might collapse if too much pressure was put on to it. In truth, the company's main fuse blew. There was no negligence on the part of the plaintiffs, nor any breach of contract.

F. DIXON, plaintiffs' electrician, said that the lights burned satisfactorily for several hours He could not help the electric lighting company's fuse blowing.

JUDGE ATHERLEY-JONES, K.C., found for the plaintiffs on the claim and counterclaim, with costs.

TRAMWAY ACCIDENT CLAIM.

THE record has been closed and issues ordered in an action in the Court of Session, against the Dunfermline and District Tramways Co., Cowdenbeath, for £750 damages. The action is a sequel to the death of an octogenarian, who was knocked down by a car.

OSRAM LAMP WORKS *v.* ELECTRIC FITTINGS, &c., CO.

IN the Chancery Division on Monday, before Mr. Justice Warrington, MR. J. H. GREY moved for judgment in default of appearance in this action. Counsel said the action was for infringement of two letters patent, certified by his Lordship to be valid.

The order made by his LORDSHIP was an injunction and inquiry as to damages, and delivering up of infringing articles.

COLNE AND TRAWDEN LIGHT RAILWAY.

THE arbitration proceedings concerning the purchase of the above tramways by the Colne Corporation were brought to a conclusion on 19th inst. The hearing occupied 10 days. Mr. A. J. Ram, K.C., intimated that he would give his decision before the end of January.

BUSINESS NOTES.

Consular Notes.—Japan.—The British Consul at Osaka reports that during the last few years a network of electric railways has been built round Osaka. Lines now run west to Kobe, north-east to Kyoto, north-west to Takaradzuka (a pleasure resort), south to Sakai and Wakayama, and south-east to Nagano, while a further line east to Nara is in process of construction. Various other schemes have been brought forward. There are at present about 140 miles of line actually in operation, mainly double line, and about 70 miles under construction or proposed. These systems are for passenger traffic only, and while competing to a considerable extent with the Government railways between the centres served, they form a cheap means of locomotion to and between intermediate points served by the latter.

Finland.—In a recent report, the British Consul at Helsingfors states that negotiations were undertaken in 1912 for the purchase, on behalf of a German syndicate, of the Wallinkoski rapids near Imatra, as well as those of the Enso and Rouhiala. It is considered that the greater portion of the power will be transferred to St. Petersburg, which capital has hitherto been dependent on coal imported from foreign countries (especially the United Kingdom) for the supply of electric power. (Since writing the foregoing, it further appears that the remaining balance of £92,252 has been paid by a St. Petersburg company for the conduit of the electric power, and that the Rouhiala and Wallinkoski rapids now definitely belong to that company.) The total cost of the rapids is said to have been £211,299. A local syndicate has acquired the Kaarannes waterfall, between the lakes Vietonen and Miekojärvi, in the parish of Upper Tornea. From this waterfall much power can be obtained. A large station is to be constructed, from which power will be transmitted to Upper Tornea. A new factory, the Aktiebolaget Finska Flatfabriken, for the manufacture of electric cables and insulated wire, was registered at Helsingfors on December 5th, 1912.

Russia.—In a report recently issued by the American Government, it is stated that the Chief Government Inspector of Factories for the Tiflis Government and Zakatal district has sent out a circular to the owners and managers of industrial enterprises in the district, in which he suggests that in view of the high price of liquid fuel in the Caucasus, they should substitute hydraulic motors for the steam boilers and internal combustion motors now in use, and in that way utilise the power of the numerous rivers and streams in the Caucasus. He calls attention to the enormous advance in the price of liquid fuel, which has been steadily increasing and will continue to increase especially in view of its use now on steamers in place of other fuel. He says oil sold in Tiflis three years ago for only 23 kopecks per pood (6½d. per 36·1122 lb.), whereas it now costs 65 kopecks per pood (16½d. per 36·1122 lb.). This is bound to have a bad effect upon the industrial enterprises in the Caucasus, nearly all of which use liquid fuel extensively. Many of them have survived with difficulty, hoping that the price would sometime be lower again. Unfortunately, these hopes are without foundation, as the world's entire product of naphtha is controlled by large foreign companies, who own most of the Baku naphtha oil fields, and are therefore the absolute masters of the industry in the Caucasus. In order to compete with them the Government has a plan to open its own naphtha works. Forty-five dessiatines (121 acres) of land are assigned for this purpose, and the estimated cost will be 14 million rubles (about £1,500,000). The railroads also have their own naphtha works. The small consumers, however, cannot have their own works. The only solution for them is to avoid as far as possible the use of liquid fuel. In order to utilise the power of the rivers and streams of the Caucasus, the Inspector recommends the construction of hydroelectrical general stations and the transmission of the electrical power there developed to the places of consumption by conduits above and below ground. Among other things, the Inspector says that one large enterprise of this kind that could furnish Tiflis with 25,000 KW., or 33,750 H.P., would be able to supply the electrical power at a charge of 4 to 6 kopecks (1d. to 1½d.) per kilowatt-hour, whereas the price of electrical power now furnished in Tiflis by the private electrical stations is 25 kopecks (about 6d.) per kilowatt-hour.

Firms wishing to communicate with the above-named Inspector should address the Chief Factory Inspector, Udelnaya Ulitza 10, Tiflis, South Russia. Letters and catalogues should be in Russian, German or French.

Hungary.—The American Consul at Buda-Pesth reports that material for electric wiring in Hungary, while differing slightly from that in use in America is essentially the same, except that it is generally a little inferior in quality. Electric wiring material of American manufacture is preferred in Buda-Pesth, but the Austrian and German manufacturers practically control the market. A certain American connector, however, is used very extensively. Nearly all the steel insulating tubes in use in Hungary are of British manufacture. The Austrian and German goods recommend themselves principally on account of their cheapness, and it is generally understood that while similar goods of American origin are more expensive, they are superior in quality. The sockets in use in Hungary are the American Edison base standard. Brick and reinforced concrete are the principal materials used in building houses in Hungarian cities, and they are fire proof to a very high degree. Staircases are constructed exclusively of stone. The height of buildings is limited by law to 25 metres, thus limiting the number of storeys to six. Iron or steel construction is very rare. Electric wiring in buildings must by law be within the

walls, and must be properly insulated, and, in addition, be enclosed in iron, steel or brass pipes.

The German and Austrian manufacturers are represented in Buda-Pest by agents, usually by persons formerly connected with the factory or with other selling agencies. These agents, who keep a large stock of all kinds of electrical goods, employ travelling salesmen, who visit periodically the important Hungarian cities and large towns. The agents, on behalf of the manufacturers, contract for advertisements in the best Hungarian trade papers. Electric goods are sold on a credit of four to six months, or against bills of exchange. German manufacturers allow 2 or 3 per cent. discount on the amount of bill when payment is made within 30 days. Payment for electrical supplies is seldom made within three months. The German manufacturers are always willing to allow four months. Other manufacturers must be prepared to offer liberal credit terms and must be represented by agents. Nearly all of the local dealers in electric supplies have contracts with Austrian, German, or English manufacturers that forbid the sale by them of goods of other manufacture.

The Hungarian Electrotechnic Association (Magyar Elektrotechnikai Egyesulet), Buda-Pesth, VII. Erzsebet-krt 48, has published a book containing the name and address of every electric light plant in Hungary, together with detailed statistics. A copy of this book will be sent by the association to any address upon receipt of 12 crowns (10s. 2d.).

The Electric Trade Outlook in Roumania.—The manufacture of electrical goods in Roumania is of small extent only; hence, imports are considerable, the principal contributing countries being Germany and Austria-Hungary. As the trade statistics do not detail lighting materials, it is very difficult to estimate the value of the imports; a rough estimate would, however, place the value at about 1,000,000 fr. About one-half of this amount represents the share of Germany, four-fifths of whose exports consist of electric lighting apparatus, and one-fifth gas and petroleum lamps. France supplies electric and gas lamps to a value of 100,000 fr.; the balance of the imports into Roumania, about 400,000 fr., being supplied by Austria-Hungary, whose share is increased by 350,000 fr. for carbons contributed by Viennese makers. A large number of provincial towns now possess their own generating stations, and the use of the petroleum lamp is steadily declining. Gasworks are only to be met with at Bucharest and Galatz: these two cities, therefore, are the only ones to count upon for a demand for gas fittings, &c. Electric lamps are imported mainly from Germany, thanks to the low prices which German makers ask, and to the fact that the greater number of electric companies are German creations. Metal-filament lamps are mostly used. Some industrial companies and the railways use carbon lamps. The trade in electrical apparatus underwent a crisis last year, owing to the losses sustained by wholesale and retail dealers on glass goods. In view of the present activity in the building trade in Roumania (there are numbers of schemes, for instance, for the construction of hotels, clubs, and public buildings, most of which are under way), there will shortly be an increased demand for lighting material, and this mainly electrical.—*Oesterreichische-Ungarische Konsular-Korrespondenz.*

New Year Festivities.—The festivities which are an annual feature of the social side of Messrs. Siemens Bros.' works at Stafford, were concluded on Saturday, the 17th inst. They commenced with a treat to the children of the employés. The place of assembly was the Siemens Institute, which was brilliantly lit up for the occasion and suitably decorated, on the stage being three ornamental Christmas trees, all of which were illuminated by electric fairy lamps. In addition to a capital entertainment, all the children received a suitable present, each little girl being given a doll and the boys and elder girls a variety of useful and ornamental articles. As the hall is not large enough to accommodate the 1,100 children to be entertained, they were divided into two groups, the party for the older children being on Friday evening, and that for the younger ones on the Saturday afternoon. The employés themselves also had their turn. On Monday night the invitations were for the staff. The rooms seemed more crowded than ever, about 500 guests being present, including most of the heads of the departments and their wives. The large hall was beautifully decorated, and the Christmas trees left from the children's party added to the gaiety of the scene. On the succeeding nights the various shops in turn were invited, and the attendance averaged quite 500 nightly. The carnival, as stated above, concluded on Saturday, 17th inst., when the female employés were the guests. Each evening entertainments were provided for the benefit of non-dancers, the artistes being employés of the company. The arrangements, which were very complete, were made by the general committee, with Mr. F. E. Read as hon. secretary. Everything, we are informed, went off most successfully.

Pictorial Advertising of Half-watt Lamps.—The German makers of Osram half-watt lamps have introduced a novel method of advertising in the daily newspapers by means of pictorial sketches purporting to show the international use of the lamps. In the first place, Turkey is depicted by the German Ambassador who, holding in one hand two German soldiers upon whom the rays of a lamp are being cast, is shown engaged in conversation with a Russian, and the accompanying words are: "Russia makes her mind easy about the German military mission now that the German Ambassador has shown this mission in the right light (Osram lamp)." The words applied to Great Britain, which is outlined with lamps erected on standards all around the coast and with a sailor lying prone in the centre, are as follows: "England has equipped the whole of her coast with Osram half-watt lamps, whose bright lustre causes her to admit that the German danger is a shadowy spectre of the sea." A French soldier fixing lamps on African territory is shown in the third place in order to give force to the statement that "France is making enormous progress in her African colonies and protectorates by the introduction of the Osram lamp everywhere on the Dark Continent." The fourth position is occupied by a Turk and a Greek, at the rear of whom are islands lighted by lamps. The words submit that "Turkey and Greece shake hands reconciled, as their final point of dispute has simply been removed by the Osram lamps having now also conquered the Ægean islands." A salesman disposing of lamps to an Albanian represents the fifth sketch with the words: "Albania orders 100,000 Osram half-watt lamps in order that brightness may at last appear in her dark and obscure conditions." The final sketch indicates China, which is portrayed by a Chinaman who is running with an Osram lamp in one hand, the accompanying words being: "The general enlightenment is also proceeding with gigantic steps in China by the introduction of Osram lamp."

Mill Lighting in Cawnpore.—We have received a letter from the VICTORIA MILLS CO., LTD., of Cawnpore, from which we gather that the notice that appeared in our issue of September 19th last year under the above heading is incorrect in several of its particulars. On making further inquiries at the source from which we obtained our information, we learn that the statement that the lamps referred to are used throughout this mill was made on the responsibility of a visitor from India who may have mixed up the names of several mills. From the Victoria Mill Co. we learn that only a few of the lamps mentioned have been used in their mill and the vibration tried them considerably. The reference to tests respecting saving of current cannot apply to the Victoria Mill as no such tests have been made. The same applies in respect to the shutting down of a dynamo consequent upon the saving effected, for that has not been done at the mill named. We hope to be able to refer to the matter at a later date as a result of inquiries that are now in the mail.

Book Notices.—*Green's Patent Fuel Economiser* is the title of a volume recently issued by Messrs. E. Green & Son, Ltd., of Wakefield, which, though styled "catalogue P 502" by the publishers, is well worthy of a place amongst the series of specialised descriptive works which modern manufacturers are gradually producing. The remarkable development of the Green economiser is well exemplified in this treatise, which shows how, invented by the late Mr. Edward Green as long ago as 1845, the original design has stood practically unchanged, except in minor details, though numerous inventors have endeavoured to improve upon it. There are few devices widely employed in engineering which can show a similar record. The book, which is handsomely produced and illustrated, deals with the theory and construction of the economiser, its application to all kinds of steam boilers, for heating both water and air, as well as to blast furnaces, coke-ovens, &c., and its use for a variety of special purposes. Tests, working instructions, and numerous plans showing the arrangement of the economiser are given, and sections are devoted to the Green boiler feed pumps and small engines for driving the scrapers.

The Central for December contains an article on the three-phase commutator motor by Dr. S. P. Smith, a summary of the progress of the College in the session 1912-13, with a plan showing the Goldsmiths' Company's extension, an article on Sound by Mr. J. T. Irwin, and other interesting items.

The contents of the *Journal* of the American Society of Mechanical Engineers have been greatly increased in scope. Commencing with the January issue the *Journal* includes the *Transactions*, and is the permanent record of the society, the republication in a separate volume as *Transactions* being discontinued.

The *Old Students' Association Magazine* of Finsbury Technical College, for December, contains a portrait of Mr. E. K. Scott, winner of the O.S.A. Medal for 1912-13, and the conclusion of an account of a visit to the Dover Harbour Works, as well as numerous items of news.

Quin's Metal Handbook and Statistics, 1914. London: L. H. Quin, 3, East India Avenue. 3s. 6d. net.—This is a very useful little book of 150 pages, in which is given a mass of statistical information, from official and private sources, regarding the metal trade of the world. The author has specialised in his subject for 20 years, and has a very intimate knowledge of the markets and market conditions. The daily prices of electrolytic copper and of copper and copper shares, copper stocks and world supplies are all fully tabulated. Other metals detailed are tin, lead, spelter and zinc, aluminium, platinum, tinplates and galvanised sheets, iron and steel. Bringing together so much information of this character in so compact a form makes the book a valuable reference work for electrical and other engineering and industrial offices.

"The Motor-Generator." By James W. Barber. London: Ganes, Ltd. Price 1s. net.

"Spon's Architects' and Builders' Pocket Price Book, 1914." London: E. & F. N. Spon, Ltd. Price 2s. 6d. net.

"Handbook on Electroplating, Polishing, &c." Birmingham: W. Canning & Co. Price 2s. 3d., post free.

"*Transactions* of the Institution of Engineers and Shipbuilders in Scotland." Vol. LVII, Part III. January, 1914. Glasgow: The Institution.

"*Proceedings* of the South Wales Institute of Engineers." Vol. XXIX, No. 6. January, 1914. Cardiff: The Institute. Price 2s. 6d.

"*Bulletin* of the Imperial Institute." Vol. XI, No. 4. October-December, 1913. London: John Murray. Price 2s. 6d. net.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIII, No. 1. January, 1914. New York: The Institute. Price $1.00.

"*Journal* of the Franklin Institute." Vol. CLXXVII, No. 1. January, 1914. Philadelphia: The Institute. Price 50 cents.

"Electrolysis in Concrete," by E. B. Rosa, B. McCollum and A. S. Peters; "High-frequency Ammeters," by J. H. Dellinger; "Electrolytic Corrosion of Iron in Soils," by B. McCollum and K. H. Logan. Washington: Government Printing Office.

"Annuaire de l'Electricité." 1914. Paris: *La Lumière Electrique*. Price 4 fr.

"Atti della Associazione Elettrotecnica Italiana." Vol. XVII, No. 24. December 31st, 1913. Milan: Stucchi, Ceretti & Co. Price L. 1.50.

"Handbook of Wireless Telegraphy." By J. Erskine-Murray. Fifth Edition. London: Crosby Lockwood & Son. Price 10s. 6d. net.

"Motoring." By A. E. Berriman. London: Methuen & Co. Price 10s. 6d. net.

"Memorandum by the Chief Engineer of the Manchester Steam Users' Association, for the Year 1912." Manchester: The Association.

"Annuaire pour l'An 1914." By the Bureau des Longitudes. Paris: Gauthier-Villars. Price 1 fr. 50 c.

"Elektrizität und Volkswohlfahrt." By Prof. A. Raps. Berlin: Verlag von G. Stilke. Price M. 2.50.

Calendars and Diaries.—MESSRS. KING & CO., of Leith, have issued a wall calendar for 1914, with monthly slips. A view of their electrical repair workshop appears above the slips.

From MESSRS. MCLURE & WHITFIELD, Mersey Dynamo Works, Adswood, Stockport, we have received one of their handy pocket diaries with full calendar and daily spaces, also accident insurance form. The opening pages, as usual, contain illustrated information of the firm's generators and motors and petrol sets.

Catalogues and Lists.—MESSRS. ERITH'S ENGINEERING CO., LTD., 70, Gracechurch Street, London, E.C.—Thirty-two-page catalogue (No. 215) describing and illustrating Erith's grateless underfeed stokers, of which over 10,000 are installed. Observations are made on combustion, boiler efficiency, air supply, range of fuels, and charts, diagrams and excellent half-tone views of their stokers applied, are contained in the brochure.

THE EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., Ponder's End.—Eight-page booklet containing illustrations from photographs of the various apartments of a house in which Ediswan "Quartzalite" electric heaters and radiators are used. Prices of the different types of apparatus shown in use are stated.

NATIONAL TIME RECORDER CO., 5, Blackfriars Road, London, S.E.—Twenty-page illustrated booklet, describing their patent fool-proof time recorders, time stamps, and portable control and signal clocks.

MESSRS. BRUCE PEEBLES & CO., LTD., Edinburgh.—Twenty-four-page pamphlet (No. 22A) in the firm's standard form, describing, excellently illustrating, and tabulating details of, their open type and self-contained end hood pedestal type induction motors. Weights and dimensions, as well as ratings and other technical data are given, as are also a list of users, and names and addresses of the firm's foreign and Colonial agents.

CAMBRIDGE SCIENTIFIC INSTRUMENT CO., LTD., Cambridge.—List No. 126 (60 pages) contains very full illustrated descriptive matter, with prices, code-words, &c., relating to the various types of galvanometers which they manufacture, including different types of moving magnet and moving coil galvanometers, and giving particulars of various galvanometer accessories. Special attention may be directed to the Einthoven string galvanometer, which has a large range of usefulness in wireless telegraphy and cardiographic work; and to the Paschen galvanometer, which is very useful for radiometry measurements and is an instrument of extreme sensitivity. Other well-known types are also described.

THE DAVIS ELECTRICAL CO., LTD., 17, Moor Street, London, W.—Circular relating to "Delcoblast," a composition for frosting electric lamp bulbs and other glass; also a blotter giving prices of same. We understand that the solution is being supplied to the Admiralty, H.M. Office of Works and other Government offices, as well as to lamp-makers and Corporations.

WESTINGHOUSE COOPER-HEWITT CO., LTD., King's Cross, London, N.—List No. 64 describes the Rectigraph for the rapid copying of drawings or documents.

MESSRS. CECIL HODGES & CO., LTD., Balfour House, London, E.C.—New catalogue of 14 pages describing fully with illustrations, and giving particulars of weights, dimensions, speeds, prices, &c., of gas, petrol and paraffin engines and dynamos, combined lighting sets, &c.

MESSRS. A. SCHONFIELD & CO. (GLASGOW), 21, Hope Street, Glasgow.—Illustrated price leaflet showing the New Junior "Hestia" electric stove, which they are now manufacturing: also a leaflet relating to their Grundy automatic temperature control apparatus.

BRIMSDOWN LAMP WORKS, LTD., Kingsway House, London, W.C.—A new price list (12 pages) of Wirum lamps is now being distributed to the trade. Prices are clearly shown for lamps of various candle powers and voltages, for interior and exterior lighting, and for traction and train lighting, as well as Wirum battery and motor-car lighting lamps. The Wirum cartons are also illustrated.

BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, London, E.C.—We have received a copy of the *Mazda House News* for January, which, like previous issues, contains a good deal of chatty and illustrated matter concerning Mazda manufactures for those interested in illumination work.

MESSRS. HENRY POOLEY & SON, LTD., Railway Department, Birmingham.—Reprint (8 pages) of an illustrated article on "Weighing Machines on Railways."

PEEL-CONNER TELEPHONE WORKS, LTD., Salford. — Bulletin No. 4, describing the company's small magneto call switchboards. New features have been introduced, making the operation of these boards practically equivalent to that of a central-battery switchboard; they are fitted with combined drops and jacks, and a new clearing drop. The operation of inserting a plug into a jack automatically restores the drop shutter: the clearing signals are located in the keyboard, and are restored by operating the combined listening and ringing key. A great saving in time and trouble is thus effected. The parts are easy of access, and special precautions are taken with apparatus for use in the tropics.

MAGNET-SCHULTZ G.M.B.H., Memmingen.—Price list of electromagnets applied to various purposes, such as work-holders, magnetic face-plates, lifting-magnets, separators, &c.

Trade Announcements.—THE LONDON ELECTRIC WAREHOUSE CO. announce that they are now in a position to quote for export requirements in "Metallum" half-watt lamps, which can be supplied in any voltage, and from 600 to 3,000 C.P.

MESSRS. E. P. ALLAM & CO. have removed from 28 to 107 and 109, Gray's Inn Road, W.C., where they have better facilities for carrying on their business of electric light and power contractors. A large stock of motors for hire is held, and a complete workshop for the repair and rewinding of dynamos and motors has been fitted up. Telephone No. as before, "Holborn 1280."

THE WALSALL ELECTRICAL CO., LTD, Walsall, announce that they will be closed from January 30th to February 5th for stock-taking. A small staff will be in attendance to deal with correspondence, &c.

THE ELECTRICAL APPARATUS CO., LTD., have now opened their Birmingham office at Carlton House, High Street, Birmingham. Mr. Way has been appointed manager of this office, and will deal with urgent inquiries from that address. Telegrams, "Elapratus, Birmingham"; telephone No. "Central 7478."

Bankruptcy Proceedings.—CHARLES BLAKE, electrical engineer, 4, Church Street, Bilston.—At the Wolverhampton Bankruptcy Court, on January 21st, bankrupt appeared for his public examination. He attributed his failure to ill-health, shortness of capital and keen competition. Debtor, who had been trading as the Bilston Electrical Co., returned his gross liabilities at £211, of which £206 is expected to rank for dividend, and his deficiency he set down at £86. In reply to questions, the debtor said that in February, 1909, he called a meeting of his creditors together, and paid 6s. 8d. in the £. Later he again got into difficulties, and offered his creditors 12s. 6d. in the £, but this was not accepted, and therefore he filed his petition. The examination was adjourned for debtor to produce an amended deficiency account, and also a trading and cash account.

W. LONGDON & V. G. COBB (trading as Longdon & Cobb), electrical engineers, Nottingham.—Trustee (Mr. E. Wynne Humphreys, 4, Castle Place, Nottingham), released December 22nd, 1913.

W. H. DAVIS (lately trading as the General Incandescent Fittings Co.), dealer in gas and electric light accessories, Saltley, Birmingham.—A first and final dividend of 4s. 4d. in the £ is payable on February 2nd at the Official Receiver's offices, Ruskin Chambers, 191, Corporation Street, Birmingham.

The "Pirelli-General" Cable Co.—A few weeks ago we published a photograph showing the progress that was being made with the erection of the new Pirelli cable works at Southampton, adjoining the Corporation electric light station. Since then the operations have advanced considerably towards completion. It is interesting to announce that the PIRELLI-GENERAL CABLE WORKS, LTD., has now been registered, with a capital of £200,000, for the purpose of manufacturing underground cables, telephone cables, vulcanised rubber wires and cables, &c. The directors of the company are six in number, three representing the Pirelli interests and three the interests of the General Electric Co., Ltd.

Motor-car Lighting and Starting.—MESSRS. DUNCAN WATSON & CO., of 62, Berners Street, London, W., have secured the sole manufacturing and distributing rights in the Bijur electric lighting and engine starting sets, which were recently described in the REVIEW, and which are now being made both in the United States and in Germany.

Electricity Meter Manufacture in Germany.—The completion of the two-millionth electricity meter at the works of the ALLGEMEINE ELEKTRICITATS GESELLSCHAFT, of Berlin, has just been celebrated. The industry was commenced in September, 1897, and within two months 1,000 instruments were turned out. The 100 000 mark was reached in May, 1902; the 1,000,000th in June, 1911, and the 2,000,000th in December, 1913.

Explanation.—MESSRS. CECIL HODGES & CO., of Balfour House, E.C., write to remove any misapprehension that has arisen owing to the illustration of the Feather's Hotel, Ledbury, appearing in their advertisement last week. They wish to make it quite clear that they do not do contracting work, and if their advertisement of electrical equipments should draw inquiries from actual users, the latter would be referred to the nearest electrical contractor in the district.

Liquidations.—DETTIFOSS POWER CO., LTD.—This company is winding up voluntarily, with Mr. H. A. McMahon, of Winchester House, Old Broad Street, E.C., as liquidator. A meeting of creditors is called for February 5th at Winchester House, E.C. Claims must be sent in by March 25th.

ENGINEERING INSTRUMENTS, LTD.—A meeting will be held at Savings Bank Chambers, Darlington, on February 26th, to hear an account of the winding-up from the liquidator, Mr. J. W. Watson.

TRAMWAYS THIRD-PARTY ASSURANCE, LTD.—This company is winding up voluntarily, with Mr. A. B. Johansung, of 90, Cannon Street, E.C., as liquidator.

LIGHTING and POWER NOTES.

Aberdeen.—At a meeting of the T.C., the town clerk submitted two letters from the Suburban Tramway Co. with reference to the proposed agreement with the T.C. as to the supply of electricity. It was pointed out that the company did not desire to contract for five years, but would prefer that the contract run from year to year. The electrical engineer recommended that the existing agreement be extended for a period of five years from June next, all the clauses remaining the same except the charge for electricity, which he recommended for the existing system should be 1⅝d. per unit on the company guaranteeing to take or pay for 140,000 units per annum. The price charged at present is 1¾d. per unit.

Argentina.—The State Electrical Board has ordered the establishment of electric lighting services at Villa Colon, La Paz and Las Piedras.—*Review of the River Plate.*

Asiatic Turkey.—According to the *Daily Telegraph*, a 40 years' concession has been granted to the French banking firm of Perrier, for the construction of a tramway from Jerusalem to Bethlehem, and the lighting of the city with electricity.

Atherton.—The B. of T. has granted permission to the R.D.C. to erect overhead wires for the supply of electricity to the Westhoughton district, and outside its area of supply.

Aylesbury.—E.L. SCHEME.—A motion that the proposed E.L. scheme be dropped, in view of a petition against it, signed by 1,850 ratepayers, was defeated at the last meeting of the U.D.C. The petition, which has been forwarded to the L.G.B., objects to the estimated cost, which has risen from the original £17,800 to £21,500.

Bacup.—A new sub-station is being constructed in Market Street by the Corporation, and in order to run part of the Plantation Mill of Messrs. Joshua Hoyle & Sons, a 75-H.P. motor is being installed.

Ballater.—E.L. SCHEME.—Mr. Duncan is to proceed with the wiring for the E.L. of the burgh. It is estimated that the installation will be in full working order by the end of July.

Bilston.—SEWAGE PUMPING.—The U.D.C. has been recommended to substitute electric power for oil in connection with the sewage works plant. The conversion is estimated to cost £250

Blackpool.—The proposed introduction of the rateable value system of charging, recently referred to in these columns, is to take effect on April 1st. The flat rate for lighting is also to be reduced from 4½d. to 4d. per unit.

Brampton.—E.L. SCHEME DROPPED.—At a meeting of the R.D.C. last week, a motion to obtain expert advice as to the feasibility of an electricity supply scheme for the town was defeated. It was proposed to obtain power from the River Gelt.

Brazil.—The first portion of the new hydro-electric station at Sorocaba of the Sao Paulo Electric Co., has just been put in operation. When the whole of the plant has been installed, it will have a capacity of 30,000 KW.

Burnham (Somerset).—The U.D.C. has decided to have the Town Hall and offices lighted by electricity "provided that suitable appliances be used and a reasonable charge made for the installation."

Canada.—By-laws have been passed in the following towns in Ontario to expend the amounts named on the E.L. undertakings—Hamilton, $335,000; Richmond Hill, $4,000; and Stouffville, $7,000.

The following towns have passed by-laws in favour of hydro-electric supplies:—Wallaceburg, Hanover, Fergus, Elora, Strathroy, Tilbury and Chatham.

Plans are complete for the steam auxiliary plant to be erected by the Dominion Power and Transmission Co. at Hamilton. It is expected that two units, with a capacity of 13,400 H.P., will be installed by next fall, and one unit will be added annually until the total capacity is 88,000 H.P. The total cost of the buildings and plant is estimated at $3,500,000.—*Canadian Engineer.*

Chiswick.—THE E.L. SCHEME.—It has now been decided to take a poll of the ratepayers on the E.L. purcha e scheme, which met with an adverse vote at the recent public meeting of electors.

Continental Notes.—FINLAND.—It is announced that the St. Petersburg Electrical Transmission of Power Co., which is declared to have a share capital of £5,200,000, has approached the Senate of Finland with the object of securing authority to erect hydro-electric works of a capacity of from 300,000 to 400,000 H.P. This scheme aims at the utilisation of the resources of Lake Saima. In the district where the suggested power station is to be erected the Vuoxen River flows from Lake Saima to Lake Ladoga, and in the first part of its course it passes over numerous falls, including the Imatra Falls, which have already formed the subject of an electrical project. At present only 4 per cent. of the enormous forces of the Vuoxen River is used by the timber and paper industries, the remainder going to waste. The ownership of the water-powers is vested to the extent of about one-third in the Finnish State, one-third is the property of industrial and private firms, and one-third is owned by the St. Petersburg Electrical Transmission of Power Co. According to a scheme prepared on behalf of the latter by a Munich firm of engineers, it is proposed to construct a dam across Lake Saima, near Vuoxenniska above Imatra, and to regulate the future discharge of the water which is to be conveyed to the power station by means of a canal of a length of 11 miles, where a useful fall of about 200 ft. is computed to be available. It is intended to install 20 turbines, each of 20,000 H.P., which will be direct coupled to generators. Power is to be transmitted to St. Petersburg, which is about 74 miles distant, and it is calculated that it will be possible to deliver 1,600,000,000 KW.-hours in the Russian capital per annum. A Helsingfors correspondent of a German newspaper states that public opinion in Finland is greatly opposed to this particular scheme, it being contended that if the power station is to be erected the natural owner should be the Finnish State. On the other hand, the Russians are said to have powerful advocates, and the present Senate is declared not to be unfavourably disposed towards them.

FRANCE.—An agreement has recently been arrived at between the French and Swiss Governments with reference to the allocation of the rights in the water power of the River Rhone, near the frontier. It has been agreed that the French and Swiss concessionnaires shall jointly build the dam near Pougny-Chanoy, from which each will draw its water to operate the turbines. Negotiations are reported to be in hand with reference to an amalgamation of the interests of the two concerns.

ITALY.—A Baden company has applied to the Italian Government for a concession to utilise the waters of the Piave for a hydroelectric installation for an output of 166,000 H.P., at a cost of 70,000,000 lire. The power will be utilised for electric driving on the railways of Upper Italy.—*Revue Pratique de l'Electricité.*

The Technical Investigation Co., which was formed some time ago by the Italian Commercial Bank, the Southern Railway Co., the Southern Electricity Co. and the Franco-Swiss Electrical Co., of Geneva, for the purpose of examining the hydraulic powers of the Sila in Calabria, has now submitted to the Italian Government four schemes which would give a total of 150,000 H.P. As, however, industries have yet to be established in that mountainous district, the promoters only desire to proceed with the utilisation of 50,000 H.P. in the first instance. It is intended to use a portion of the energy for the production of carbide of calcium, and to distribute the remainder for industrial and lighting purposes at distances of up to 170 miles. The capital required for the execution of the scheme is put at £2,000,000, which is said to have been raised by the four promoting companies previously mentioned.

SWEDEN.—It is reported that a scheme has been agreed upon between the Ljusne Iron Works Co. and the Bergvik Ala Nya Cellulose Works for the establishment of a plant to utilise the water power of Lake Marmen to generate electricity, part of which will be utilised by the companies themselves, and the balance distributed in the district.

Coventry.—The City Council decided on Tuesday to purchase sites for two additional sub-stations.

Croydon.—The B.C. has resolved to oppose the L.B. and S.C. Railway Co.'s Bill, with respect to the provision of electricity, and the South Suburban Gas Co.'s Bill relating to the generation and disposal of electricity.

Deal and District.—E.L. PROPOSALS.—At a meeting last week of representatives of the Town Councils of Deal, Sandwich and Dover, the Walmer U.D.C. and the Eastry R.D.C., a resolution was passed recommending each body to oppose the Deal and Walmer Gas and Electricity Bill, on the ground that the granting of a monopoly for an indefinite period is to be strongly deprecated.

Dublin.—The Alliance and Dublin Gas Bill, which authorises the company to supply electricity within the urban districts of Blackrock, Kingstown and Dalkey, has been forwarded for the first reading.

Dudley. — ANNUAL ACCOUNTS. — The Corporation's abstract of accounts has been issued this week, and they show that on the electricity undertaking the expenditure has been £7,958, including £2,538 in respect of interest on mortgage loans paid and accrued, £4,900 repayment of loans, and £519 bank charges. The revenue reached £5,039, and the net loss for the year was £2,918. The deficit for the previous year was £2,662, so that the total net loss up to March 31st last was £5,580,

Glasgow.—POLICE LAMPS.—It is stated that the electric lamps with which the police are provided are too delicate for the knocking about to which they are liable, and that a stronger lamp will probably be introduced.

Greenock.—LOAN SANCTION.—The Secretary for Scotland has consented to the Corporation borrowing a further sum of £30,000 for extensions to the electricity undertaking.

Harwood.—THE E.L. SCHEME.—At a meeting of the D.C. last week, the chairman observed that if something was not arranged soon regarding the supply of electricity from Accrington, the D.C. would have to undertake the supply itself.

Hornsey.—NEW LOAN.—The T.C. has approved the borrowing of £3,000 for the purposes of the electricity undertaking.

Huddersfield.—LOAN SANCTION, &c.—The L.G.B. has sanctioned the borrowing by the T.C. of £30,000; the sanction to borrow £5,000 for motors has been returned for cancellation.

The Electricity Committee has recommended the acceptance of the tender of the British Westinghouse Co. for a condensing plant.

Hull.—ESTIMATES FOR 1914.—The Corporation electricity department estimates for the ensuing year show an expenditure of £85,718, as compared with £77,526 for 1913. The estimated expenditure for fuel is increased from £16,204 to £20,484, and wages from £6,578 to £7,450. The estimated receipts by meter are £81,751, compared with £73,438 last year, and the balance in hand £3,147 as compared with £2,394.

The electrical engineer stated that by reason of the large recent extensions not having approached their full earning capacity, the capital charges per unit were considerably heavier than might be expected in subsequent years.

SUPPLY TO HESSLE.—The Committee has under consideration the supplying of electricity to Hessle. There is some opposition to the Corporation paying about £500 in connection with the expense of the prov. order. At a meeting of the Committee on January 22nd, Ald. Brown urged the Corporation to go ahead with laying the mains, or the new houses would be fitted with gas.

The Chairman stated that the electrical engineer had suggested that the supply of electricity to the Pickering Park district should be part of the scheme to supply electricity to Hessle.

India.—The *Indian Textile Journal* states that Messrs. Crompton & Co., Ltd., have applied to take up the triple scheme for Lucknow, Allahabad and Bareilly, in connection with the scheme for the supply of electricity in the United Provinces.

Irish Train Lighting.—The Midland Great Western Railway Co. (Ireland) states that in the course of a few months the third-class carriages on its system are to be electrically lighted.

Kettering.—The U.D.C. has decided to extend the electricity mains to the site of the proposed garden suburb in the Pytchley Road neighbourhood.

NEW LOANS.—The U.D.C. has applied to the L.G.B for a loan of £2,000 for mains and services.

Kilbowie.—Owing to the failure of the electric power at Singer's sewing machine factory on Thursday, last week, at Kilbowie, several departments were stopped, 5,000 employés being rendered idle.—*Pall Mall Gazette.*

Leicester.—STREET LIGHTING : ELECTRICITY *v.* GAS.—The Watch Committee has decided to have King Richard's Road lighted by electricity, and Hinckley Road by gas, for the purpose of an experiment before considering the question of the reorganisation of the whole of the street lighting of the town.

Liverpool.—ANNUAL REPORT.—In his report for the past year the City electrical engineer states that the reconstruction of the Lister Drive No. 1 station has made satisfactory progress. Three of the water-tube boilers have been in commission since the end of November, and it is expected that the reconstruction of the first section of the boiler house will be completed before the end of March next. The extension of the H.T. mains from Lister Drive power station to the Edge Lane district, and the continuation to Smithdown Road sub-station is practically completed. Provision is also made for additional sub-station plant, which the engineer anticipates may be necessary owing to the increased demand and the rapid development in the use of electricity for power purposes.

London.—HACKNEY.—The Electricity Committee has recommended the B.C. to oppose the North Metropolitan Electric Power Supply Bill and the London Electric Supply Bill, if protective clauses cannot be secured.

The Committee also recommended the Council to concur in the resolutions of the Conference of London Municipal Authorities owning electricity undertakings. The Conference protested against the action of the L.C.C. in altering the maximum periods for the repayment of loans for electricity undertakings, and attempting to alter the periods of existing loans without consulting the Councils concerned, and resolved that, as the question of loan periods is very unsatisfactory, the L.C.C. be requested to call a conference of the metropolitan Borough Councils authorised to supply electricity to consider the whole subject; more particularly, having regard to the report of the L.C.C. Finance Committee in the case of the Southwark B.C.; and that, in the meantime, the L.C.C. be urged not to recommend any variation in the existing loan periods.

WOOLWICH.—At the last meeting of the B.C., the Electricity Committee reported that, notwithstanding the low rates quoted, it had not been successful in its negotiations for giving the Erith U.D.C. a bulk supply. The Committee reported that it had also been unsuccessful in inducing the Bexley U.D.C. to take a bulk supply.

The B.C. has decided to ask the Shoreditch Conference to organise a combined opposition of all B.C.'s owning electricity undertakings to the London Electric Supply Bill. In the event of the Conference deciding not to oppose the Bill, the General Purposes Committee proposes, in consultation with the Electricity Committee, to decide whether a petition shall be presented against the Bill from the Woolwich B.C. only.

MARYLEBONE.—The B.C. has decided to deposit a petition against the London Electric Supply Bill. The E.S. Committee states that the Council is not directly affected by the Bill, but it would prolong the period before which the whole of the electrical undertakings in London might come under the management of the L.C.C.

The L.C.C. has also decided to oppose the London Electric Supply Bill.

Lowestoft.—ANNUAL REPORT.—The E.L. Committee reports that the electricity undertaking showed a credit balance on the past year's working of £171, but after allowing for the expenditure on the showroom account, &c., there was a deficiency of £191. The total receipts were £16,976, compared with £15,992 in the previous year. The working expenses amounted to £9,268, as against £8,502, leaving a gross profit of £7,708; £2,335 was paid into the sinking fund, which now stands at £4,513. During the year 129 new consumers were connected.

Mountain Ash.—The U.D.C. had decided to apply to the B. of T. for consent to use overhead wires for the supply of electricity in the Ynysybwl district at a pressure of 230 volts.

Newfoundland.—According to the *Pall Mall Gazette*, a concession has been granted by the Government for the use of 1,000,000 H.P. of water-power at Grand Falls, Labrador, for the generation of electricity, which will be used to manufacture nitrogen fertilisers from the air.

Peterborough.—The Electricity Committee has decided, before fitting ordinary mechanical stokers to the six boilers, to try two sprinkler and coking types of stoker.

The city engineer has been instructed to report upon the practicability of overhead transmission of electricity.

The T.C. has decided to apply to the L.G.B. for sanction to borrow £2,850 for the electricity works, viz., £1,350 for extension of works, £1,000 for mains and £500 for services.

Scarborough.—E.L. PURCHASE SCHEME.—At a meeting of the Corporation on Monday, last week, a report on the proposed purchase of the E.L. undertaking was considered, and the matter was again deferred

Southend-on-Sea.—NEW COALING PLANT.—In order to provide facilities for delivering sea-borne coal to the electricity works, the T.C. has authorised the surveyor to construct an electric tramway on the loading pier, at an estimated cost of £500, and is applying to the L.G.B. for sanction to borrow £1,350, the estimated cost of an electric crane and grab and the laying of track and overhead cables on the pier. It has also decided to purchase three electrically-driven coal trucks, at an estimated cost of £1,300.

St. Helen's (I. of W.).—PUBLIC LIGHTING.—The U.D.C. has accepted the offer of the Isle of Wight Electric Light and Power Co., Ltd., for public lighting in the St. John's district for 10 years, at £2 12s. 6d. per lamp per annum, subject to a revision of the price at the end of five years.

Tintwistle. — PUBLIC LIGHTING. — The P.C. has appointed a committee to consider the question of the public lighting of the parish.

Tynemouth. — ANNUAL REPORT. — The electrical engineer's report shows that the net profit for the past year was £945, as compared with £1,305 for the previous year. The number of units sold from the mains was 1,760,471, and three-phase units 1,361,694, a total of 3,122,165 units, an increase of 246,432. The number of units bought in bulk was 1,985,631. The cost per unit was 1·761d., and the average price charged was 1·78d.

Trimdon (Co. Durham).—The P.C. proposes to install electric light next season

West Yorkshire.—E.L. PROPOSALS.—At a meeting of the Mytholmroyd Council last week, a ratepayers' petition was presented urging it to provide an electricity supply, and a letter was read from the Yorkshire E.P. Co. asking the Council to support its application for powers to supply electricity for lighting purposes.

A communication from the Stainland Council urged it to oppose the application on the ground that it would create a monopoly of supply; eventually the whole subject was referred to a committee appointed to deal with the matter. The Skipton Council has decided to oppose the Bill and to obtain a renewal of its prov. order; the East and West Ardsley D.C. has referred the matter to the General Purposes Committee; and the Selby U.D.C. has decided to hold a special meeting on February 3rd to consider a resolution that it should oppose the Bill. The New Mill D.C. decided not to entertain the company's proposal, but to approach the Huddersfield Corporation to ask what it was prepared to do with regard both to lighting and tramway services.

Walthamstow.—The electrical engineer's report as to proposed extensions to the boiler house plant, has been adjourned by the Lighting Committee for further consideration at its next meeting. The engineer has been instructed to submit plans of the proposed extensions.

West Ham.—PROPOSED LOANS.—Application is to be made to the L.G.B. for sanction to borrow £13,500 for transformers, sub-station and switchgear; £12,750 for mains; and £4,000 for services.

Willesden.—The U.D.C. is petitioning against the N. Metropolitan E.P.S. Bill.

Winchester.—RATING APPEAL.—The City Council has notified the B. of G. of its intention to appeal against the assessment of the electricity works, which is £1,900.

TRAMWAY and RAILWAY NOTES.

Accrington.—NEW CARS.—A Sub-Committee visited Dewsbury on January 23rd to inspect a new type of car with radial truck and extended wheel base. The Corporation has decided to purchase five additional cars, and the visit was in furtherance of investigations with a view to finding the most suitable type of car.

Ardsley.—The B. of T. has decided to hold an inquiry relative to the application of the Wakefield and District Light Railways Co. for sanction to abandon certain authorised lines not yet constructed. The Council has decided to be represented and to oppose the proposed abandonment.

Brentford.—The Tramways Co. has written the U.D.C. with regard to its complaint as to the tramway track in High Street to the effect that although it was beginning to show wear the track was still in a good state of repair; the company had under consideration, however, a scheme for relaying the whole of the track.

Burnley.—TRAMWAY EXTENSIONS.—The Tramways Committee has recommended the T.C. to construct tramways in Stoneyholme. There will be three sections, with a total length of 5,102 yards. The cost is estimated at £39,530—viz., track and overhead equipment, £26,730; 12 cars, £10,800; street improvements, £1,000; and depôt extension, £1,000. Single-deck tramcars will be used, owing to the bridges on the route.

Continental Notes.—AUSTRIA.—A preliminary concession has been granted in respect of a system of electric tramways in the town and district of Cracow.

ITALY.—A concession has been granted in respect of a projected electric railway, partly underground, to serve the town and district of Naples. The line will comprise a double track on which a 3-minute service of three-car trains will be run, the maximum speed allowed being 19 miles per hour.

A new electric railway has lately been completed and put in operation between Busca and Bussoleno.

NORWAY.—RAILWAY ELECTRIFICATION.—This question has been under consideration for several years, and the railway authorities have now worked out a scheme for the electrification of the railway between Wrammen and Kristiania, which has the largest traffic, and will be the first section to be taken in hand. The results have been submitted to the Department for the Interior, and the single-phase system at 15,000 volts and about 15 cycles per second is recommended. It is considered desirable to increase the maximum speed, according to a previous estimate, which was 70 km. per hour, to 80 km., which would reduce the time for the express trains between the two towns by 10 min. The locomotives would be constructed for a maximum speed of 90 km. A new time plan has been worked out in accordance with the altered speed, and the estimate of the consumption of energy is 6,500,000 KW.-hours per year, and the maximum load between 5,300 and 5,600 KW. As it would be difficult to employ steam locomotives as a reserve, the power stations are to be capable of supplying the whole amount of energy at any given time, on the basis of the full maximum load. The railway will serve as an experimental plant, from which experience can be gained before the other sections of the railways are taken in hand.

RUSSIA.—A company has been formed with a capital of £168,600 to construct and work an electric railway between the towns of Kiew and Bedwardanitza.

Negotiations are in hand with reference to the construction of about eight miles of new electric tramways in the city of Odessa.

SWEDEN.—The electrification of the railway between Kiruna and the Norwegian frontier is now approaching completion, and the first trial with an electrically-driven train has been made. The result of the experiment was very satisfactory. From April 1st it is the intention to run electrical passenger trains after sufficient experience has been obtained by the running of mineral trains.

GERMANY.—The crisis in the Bavarian Cabinet centres almost entirely round the questions, whether the electrification of the State railways shall be delayed, and to what extent the State shall undertake the development of the water powers for traction and industrial purposes. The defeat of the Minister of Communications will hasten the electrification, and probably the power scheme will be run by a company in which the State holds a majority of the shares.

At the end of 1913 there were in Berlin 3,072 horse cabs, 1,962 driven by petrol, and 475 accumulator taxicabs.

Dover.—TRAMWAY RENEWALS.—After an inspection of the tramways permanent way, the borough surveyor has reported that renewals and repairs estimated to cost £3,477 are required. The general manager of the tramways, reporting on the condition of the cars and general equipment, suggested that the reserve fund should be increased from 1 to 4 per cent. of the annual revenue, with a view to carrying out certain renewals forthwith.

Dudley.—ANNUAL ACCOUNTS.—The abstract of the Corporation accounts issued this week shows that on the tramway account there is a balance of £4,552, but in view of the liabilities to be provided for on loan account, no contribution has been made towards the rates.

Huddersfield.—The Corporation proposes to lay a double line of tramways to Marsden, and the U.D.C. is to be informed accordingly.

Glasgow.—The Tramways Committee is considering a suggestion that a tramway should be laid in Polmadie Road to link up the district with other parts of the city.

Leith.—PORTOBELLO EXTENSION.—The Tramways Committee is to have another conference with the Edinburgh Town Council regarding the proposed extension of the tramways to Portobello.

Liverpool.—The Corporation Tramways and Electricity Committee has decided to recommend the City Council to place £125,000 towards the reduction of the rates, viz., £100,000 from the tramways and £25,000 from the electricity department. Last year the amount received from the tramways was £66,000 and from the electricity department £30,000. This is a larger surplus than has ever before been placed to the reduction of the rates.

London.—WEST HAM.—The Tramways Committee is again recommending the Council not to take any action on the suggestion that tramway tickets should be issued in packets at a discount. The tramways manager states that books of tickets, at their face value, have been in force for a number of years, but there has been little or no demand for them, while return tickets have been readily taken up, which, he thinks, will be of more value than discount tickets.

LONDON AMBULANCE SERVICE.—The L.C.C. has advised the Metropolitan Asylums Board that it will be acting *ultra vires* in giving effect to its scheme for providing an ambulance service. The Ambulance Committee of the M.A.B. states that it does not know on what grounds the Council was advised that the Board would be acting *ultra vires* in carrying out the scheme, and that this would seem to be a question for the Board to settle on the advice of its own legal advisers. The Committee concluded that London must now wait for a further indefinite period for a street accident service, which the Board was prepared to provide by Midsummer next.

Manchester.—ALL-NIGHT SERVICE.—The Tramways Committee has decided to continue the hourly service of tramcars during the night. The chairman stated after the meeting that the loss had been less than was anticipated, and so far as he could see from the returns presented by the general manager, the all-night service had come to stay.

Newcastle-on-Tyne.—A B. of T. inquiry was held by Colonel von Donop on January 21st into the collision between two electric trains, which occurred at the Central Station on the 6th inst. The driver of the colliding train said he drove the train from Tynemouth to Newcastle, and used the Westinghouse brake, which appeared satisfactory, at all the intermediate stations. The destination signal indicated that he was to run into No. 2 platform, and the platform signal indicated that there were other vehicles at that platform. The signal was passed at walking pace, and it was not until within 4 yards of the stationary coaches that he realised he would be unable to avert a collision, which, however, was very slight. He attributed the mishap to the greasy condition of the rails. The guard, a platform foreman and a signalman, corroborated the evidence of the driver. Examiner G. Smith stated that he examined the colliding carriage, and found the brakes in perfect order.

Preston.—Owners and occupiers of property in Adelphi Street and Plunginton Street have petitioned the Corporation protesting against the Adelphi Street tramway extension for which the Corporation is seeking powers. It is submitted that the proposed extension is not required, and that the streets are too narrow.

Rawtenstall.—HALFPENNY FARES. — The T.C. has instructed the tramways engineer to obtain information from other towns where halfpenny fares are in operation with a view to adopting the same, if practicable, on certain of its routes.

Rochdale.—A proposal is before the T.C. for the erection of new depôts in connection with the tramways department. The general manager states that 10 or a dozen cars have to remain in the open during the night with the result that they rapidly deteriorate.

South Shields.—The Tramway Committee has recommended the Council to adopt a system of electric motor-'buses to link up the town with the outlying districts.

U.S.A.—It is expected that all local trains between Broad Street Station (Philadelphia) and Paoli and Chestnut Hill will be operated electrically before the end of the year. It is estimated that 3,750 KW., at 25 per cent. load factor, will be required to operate the service, and the Pennsylvania R.R. Co. has contracted with the Philadelphia Electric Co. to supply the power for five years. The complete electrification embraces 32 miles of suburban lines.

It is stated that the extension of the electric lines of the New York-New Haven Railway will be on a three-wire system, with 22,000 volts between adjacent trolley wires, and a common track neutral; this will give the same operating pressure (11,000 volts) as now employed, but it is hoped to largely reduce the rail return current, saving distribution losses and reducing magnetic disturbance to adjacent telegraph systems.

According to a recent estimate, there is now 2,138 electric motor-cars—both pleasure and industrial—in service in the New York district. The New York Edison Co. is supplying current for the charging of 1,300 vehicles, the consumption for 1913 being estimated at 8,000,000 KW.-hours.

ELECTRIC 'BUSES.—A company has been formed to start a service of electric motor-'buses in New York. The vehicles to be employed are of the single-deck type, with accommodation for 32 passengers, all facing forward. Four motors are employed, one for each road wheel, while the battery is slung below the chassis, and occupies practically all the space between the wheels.

EDISON-FORD "ELECTRIC."—It is reported from the United States that Mr. T. A. Edison, in conjunction with Mr. Henry Ford, head of the Ford Motor Co., of Detroit, is bringing out an Edison-Ford light electric car. The new vehicle, which is expected to take as prominent a position in the motoring world as has the Ford petrol car, will be able to cover a distance of 50 miles, at a speed of 25 miles per hour, on one charge of the battery, and 75 miles at 15 miles per hour. According to the *Electrical World*, the new Ford electric will be built in a special factory, and will weigh 1,100 lb., including a 405 lb. battery equipment. An experimental car is now in use in Detroit, and the price is to be less than $1,000, and possibly as low as $600.

TELEGRAPH and TELEPHONE NOTES.

India.—The erection of wireless stations in Madras, Secunderabad, Peshawar and Quetta is proceeding rapidly. Lahore, Nagpur, Karachi and Bombay have already been provided with such stations (each with a range of some 600 miles), and the last two are now available for communication with ships at sea. All the leading steamship lines plying to Indian, Burmese and Ceylon ports have fitted their passenger steamers with wireless apparatus. A recent application from the leading shipping firms has resulted in the opening for work by night, as well as by day, of the stations at Karachi, Calcutta, Diamond Harbour, Mergui and Cape Victoria (the southern extremity of Burma). With the opening up of the Madras station (and there is one at Colombo), practically the whole area of the Bay will be within range of some wireless coast station.

Submarine Telegraphy.—At a sitting of the Dominion's Royal Commission last week, Mr. F. C. Crawford, chief of the submarine cable-laying department, and Mr. Rollo Appleyard, chief of the submarine core-manufacturing department of the Silvertown works, gave evidence that during recent years the speed of transmission had increased by 50 per cent. or more, and accuracy had been improved. The cost of a modern Atlantic cable to give a speed of 40 words a minute would be about £500,000. Mr. Appleyard said there was no prospect of a reduction in the cost of construction and working of cables. The advent of wireless telegraphy had in no way diminished the activities of the cable companies—quite the contrary. He had no fear whatever of the competition of wireless with submarine cables; it would be a feeder rather than a competitor. He did not see how wireless could ever become a secret system. The Empire Press Union forwarded to the Commission a communication urging that the laying of a State-owned cable across the Atlantic was an Imperial necessity for the interchange of news through the medium of the Press.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—SYDNEY (NEW SOUTH WALES).—March 18th. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

March 2nd. Sydney Harbour Trust. Circular Quay. Three electrically-operated semi-portal travelling cranes for Berths Nos. 1, 2 and 3, Woolloomooloo Bay. Particulars from Engineer-in-Chief of the Trust.

March 25th. N.S.W. Railways and Tramways Department.—Five 1,000-KW. sub-station units to specification No. 124. Particulars at Electrical Engineer's Office, 61, Hunter Street, Sydney.—*Tenders.*

ADELAIDE.—February 11th. P.M.G. 50 cable terminals. See "Official Notices" January 9th.

MELBOURNE.—February 17th. P.M.G. Cable boxes. See "Official Notices" January 9th.

February 18th. 1,590 opalescent arc lamp globes for City Council. See "Official Notices" January 23rd.

April 7th. P.M.G. Accumulator batteries (Tudor) for radio-telegraph stations. See "Official Notices" to-day.

April 7th. For the Postmaster-General. Relays, non-polarised, Stores Schedule 996. See "Official Notices" to-day.

HOBART.—March 2nd. For the Postmaster-General. Telephones, common battery, wall pattern, and table pattern, Schedule T 104. See "Official Notices" January 16th.

Aberdare.—January 31st. Corporation. Four double-deck tramcars. See "Official Notices" January 16th.

Ballyconnell (Co. Cavan).—February 14th. Horizontal gas engine and suction plant; 18-KW. dynamo and motor dynamo; storage battery and accessories; switchboard and connections; overhead mains and street lamps, for Ballyconnell Electric Light and Power Co. See "Official Notices" to-day.

Belfast.—February 23rd. Corporation. 12 months' supply of stores for Tramways and Electricity Committee. See "Official Notices" to-day.

Belgium.—February 16th. The authorities of the Fonderie Royale des Canons, in Liége (80, Quai Saint-Leonard), are inviting tenders for the supply of two semi-fixed steam engines for the electric lighting station at the Beverloo Camp.

The municipal authorities of Ghent have this week invited tenders for the supply of the electricity meters required in that town during a period of three years.

Birmingham.—February 11th. Electrical stores for a year, for the Birmingham, Tame and Rea District Drainage Board. Mr. J. D. Watson, engineer, Tyburn, Birmingham.

Blackburn.—February 14th. Corporation. Twelve months' supply of stores for Electricity Department. Specification (deposit 3s. per section) from Mr. P. P. Wheelwright, Corporation Electricity Works. See "Official Notices" to-day.

Bosnia.—The municipal authorities of Gorazda, in Western Bosnia, are about to invite tenders for the electric lighting of the town.

Bradford.—February 19th. Corporation. Cooling towers and induced draught plant. See "Official Notices" to-day.

Bristol.—February 12th. Corporation. 12 months' supply of electrical stores. See "Official Notices" to-day.

Cape Colony.—February 28th. The municipality of Paarl, Cape Province, invites tenders for the installation of generating plant by water power. Plans and specifications from the Town Clerk, Municipal Office, Paarl, or from the consulting engineer, Mr. Thomas Stewart, St. George's Chambers, Cape Town, (two guineas). Tenders to Town Clerk.

Cheltenham.—January 31st. Corporation. Twelve months' supply of electric light fittings, and other stores. Particulars from Mr. J. S. Pickering, Borough Engineer, Municipal Offices.

Chesterfield.—February 9th. Overhauling and renewing telephones at Penmore Hospital, for the Chesterfield Joint Hospital Committee. J. Middleton, Law Clerk, 24, Gluman Gate, Chesterfield.

Colchester.—February 7th. Electrical fittings for lighting, electrical equipment for cars, overhead equipment, car fittings, &c., for the T.C., for a year. Mr. R. C. Bullough, general manager and engineer of the tramways, Magdalen Street.

Croydon.—February 16th. Corporation. 12 months' supply of stores for electricity department. See "Official Notices" to-day.

Dundee.—January 30th. Corporation. (*a*) 5,000-KW. steam turbine and alternator; (*b*) condensing plant; (*c*) 750-KW. rotary converter, with transformer. See "Official Notices" Jan. 2nd.

Germany.—February 4th. The State Canal authorities at Minden, Westphalia, are inviting tenders for the supply and erection of a 20-ton electrically-operated rotating crane.

Greenock.—February 11th. Harbour Trust. 150-ton electric crane. Specification, &c. (deposit £1), from Engineer's Office, Municipal Buildings.

Halifax.—February 16th. Corporation. Stores and materials for the electricity department. See "Official Notices" January 23rd.

Hammersmith.—February 4th. Corporation. Stores for the electricity department. See "Official Notices" January 23rd.

Hornsey.—February 24th. Corporation. Electricity meters, cables, cable stores, &c. See "Official Notices" to-day.

Huddersfield.—Corporation Tramways. Tramwaymen's uniforms. Tramway Manager's Office, Northumberland Street, Huddersfield.

Hyde.—February 4th. Corporation. Electric light installation for the Public Hall, police and other buildings. Specifications from Mr. J. H. Fletcher, architect, 45, Clarendon Place, Hyde.

Ipswich.—January 31st. Corporation. Alternator, transformers, switchboard and rotary converters. See "Official Notices" January 2nd.

Italy.—SAVONA.—February 10th. Tenders are invited for the supply by foreign firms of a centrifugal fan, with electric motor, and other machine tools (air compressor, boring and polishing machines, &c.), for the locomotive shops at Savona and Rimini. Particulars from the Direzione-Generale, Ferrovie della Stato, at the places named, or at Rome.

Keighley.—February 7th. Electrician's work for a year, for the Keighley and Bingley Joint Hospital Board. Mr. J. N. Clarkson, clerk, North Street, Keighley.

Leeds.—February 21st. Corporation. Twelve months' supply of coal and other stores, including a number of electrical items. See "Official Notices" January 23rd.

Liverpool.—February 12th. Corporation. About 100 standard traction 40 H.P. double-motor equipments. Mr. C. W. Mallins, general manager, Corporation tramways.

London.—L.C.C.—January 30th. Metropolitan Water Board. Twelve months' supply of electric lamps, wire and accessories, &c. Clerk of the Board, Savoy Court, Strand.

February 17th. Installation at County Secondary School, Hilly Fields, Brockley, S.E. (223 points, 312 lights). See "Official Notices" to-day.

BERMONDSEY.—February 5th. Corporation. Stores for the electricity department. See "Official Notices" January 23rd.

ST. MARYLEBONE.—February 11th. Corporation. Underground cables, house cables, flexible cords, rubber goods, box compound and insulating materials, &c. See "Official Notices" January 9th.

HACKNEY.—Corporation. 12 months' supply of coal for the Electricity Committee. The Engineer, Electricity Works.

ISLINGTON.—February 25th. Natural draught cooling tower and pipework for Lighting Committee. See "Official Notices" to-day.

Manchester.—February 17th. Corporation. Twelve months' supply of stores for Tramways Committee. See "Official Notices" to-day.

Newport.—February 16th. Corporation. 12 months' supply of stores, for electricity and tramways department. See "Official Notices" to-day.

New Zealand.—March 26th. The Dominion Portland Cement Co., Ltd.—Hydro-electric plant, Wairua Falls.—Section 1: Hydraulic equipment, including turbines (1,500 H.P. each), governors, penstocks, valves, &c. Section 2: Generators (1,000 KW. each), exciters, automatic regulators, &c. Specifications (£2 2s.) from S. Irwin Crookes, consulting engineer, Auckland.—*Tenders.*

Portsmouth.—February 17th. Corporation. Twelve months' supply of stores for the Tramways Committee. See "Official Notices" to-day.

Norway.—February 6th. Norwegian State Telegraph Department. 265,000 insulators. Local representation. Particulars from Tekniske Avdeling, Telegrafstyrelsen, Hasselgaarden, Christiania.—*Board of Trade Journal.*

Pontypridd.—February 9th. Corporation. Stores and materials for the electric light and tramway department. See "Official Notices" January 23rd.

Rhondda.—February 17th. U.D.C. Consumers' electric supply meters for the Gas and Water Committee. See "Official Notices" to-day.

Spain.—February 7th. Tenders are being invited by the municipal authorities of Petin (Province of Orense) for the concession for the electric lighting of the town during a period of 20 years.

Stalybridge.—The engineer to the Stalybridge, Hyde, Mossley and Dukinfield Joint Tramways Board (Mr. R. Blackmore) has been instructed to obtain tenders for the supply of a 1,500-KW. plant.

Sheffield.—February 3rd. Corporation. Contract No 111. Structural steelwork for carrying coal shoots, coal bunkers and railway sidings over same at Neepsend. See "Official Notices" January 16th.

Turkey in Asia.—March 14th. Forty years' electric lighting concession for Trebizond municipality. Population 50,000 to 60,000; 12 miles of street lighting. Houses mostly occupied by poorer classes. Water power (Deirmen River) available. An English translation of the conditions may be seen at the Board of Trade Commercial Intelligence Department in London.

West Ham.—February 6th. Corporation. Stores for the electricity department. See "Official Notices" January 23rd.

CLOSED.

Admiralty.—Messrs. Johnson & Phillips, Ltd., have in course of erection for the Admiralty, switchboard, battery, and booster and cables to its special requirements, in connection with the supply of light and power to the aviation schools and factories at Eastchurch.

Australia.—The following tenders have been accepted by the P.M.G.'s department:—

N.S.W.—
250 telephonemeters, £1 4s. 9d. each.—Western Electric Co. (Aus.), Ltd.
4,500 three-steel conductor cords, 10 ft. long, 1s. 11·4d. each.—Lawrence and Hanson Elec. Co., Ltd.

QUEENSLAND.—
6,000 dry-cells, 2s. 9d. each.—Brisbane Electrical Co.

WESTERN AUSTRALIA.—
Conduit steel, couplings, elbows, tees, saddles, clips and ebonite bushes.—W. G. Watson & Co., Ltd.
20 tons h.d. copper wire, 200 lb. per mile, £85 per ton.—Gibbs, Bright and Co.

VICTORIAN WORKS DEPARTMENT.—
Storage battery at Hospital for Insane, Mont Park, £156.—Sutherland and Ashman.

NUNAWADING.—Shire Council.
High and low-tension switches and testing sets, £153.—Noyes Bros. (Melb.) Pty., Ltd.
High and low-tension insulators and pins, £153.—Warburton, Franki (Melb.) Pty., Ltd.
H.T. watt-meter, testing set, meters and fuses, £343.—Australian Metal Co., Ltd.
Transformers, £245.—Union Electric Co. (Aus.), Ltd.

—*Australian Mining Standard.*

Barnes (Surrey).—The U.D.C. has accepted the tender of Messrs. Green & Sons, of Hammersmith, W., for installing the E.L. on the staircase of Castelnau Mansions and Castelnau Gardens.

Belgium.—Five German and one Belgium concern submitted tenders last week to the Belgian Post and Telegraph Authorities in Brussels for the supply and laying of a quantity of telephone cables in the Liége district, the lowest offer being that of Messrs. Felten & Guilleaume, of Mulheim-am-Rhein.

Croydon.—The tender of Messrs. Cory & Sons, Ltd., has been accepted by Croydon T.C., for the supply of 5,000 tons of Murfield washed pea nuts, at 16d. 5d. per ton.

Dover.—The following tenders have been received by the T.C. for tramway rails and fishplates:—

	Rails, per ton.	Fishplates, per ton.
Hadfield's Steel Co., Ltd.	£10 7 6	—
Lorain Steel Co., Ltd.	7 9 0	£9 0 0
Dick, Kerr & Co., Ltd. (50 tons)	7 8 0	9 5 9
" " " (100 tons)	7 0 0	

The offer of Messrs. Dick, Kerr & Co., Ltd., is recommended for 50 tons of rails and the requisite supply of fishplates. The tender of the City Tailoring Co. has also been accepted, at £104, for the supply of uniform clothing to the tramways department.

Harrogate.—The T.C. has accepted the tender of the Chloride Electrical Storage Co. for the repair of the battery at the Royal Baths, and also for the supply of a new storage battery.

Huddersfield.—The Electricity Committee has accepted the tender of the British Westinghouse Electric and Manufacturing Co. for condensing plant.

Leicester.—The T.C. has accepted the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for a turbo-alternator, at £11,352; that of the Brush Electrical Engineering Co., Ltd., for 10 canopy-top tramcar bodies, at £3,842; and that of Messrs. Dick, Kerr & Co., Ltd., for the electrical equipment and trucks for the cars, at £3,846.

Post Office.—Messrs. Johnson & Phillips have in course of erection, for H.M. Post Office Telegraphs, a complete electrical equipment for the wireless telegraph station, Valencia, Co. Kerry, Ireland, one of the largest coast stations installed by the Post Office.

(*Continued on page* 190.)

THE LLOYD ELECTRIC VEHICLE.

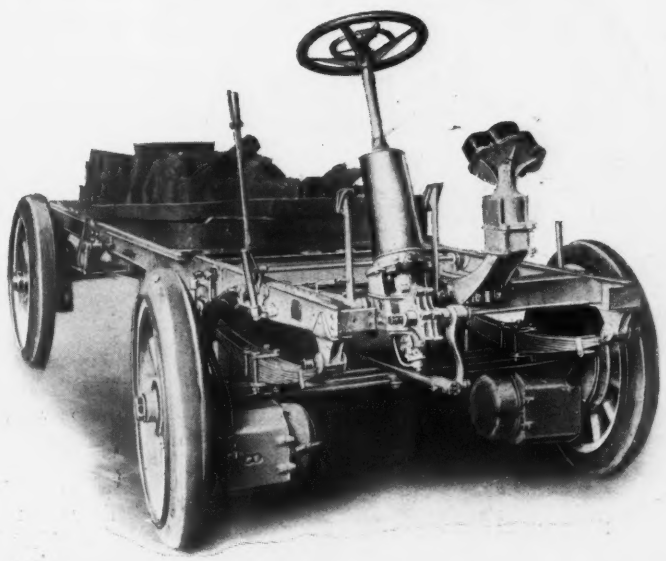
THROUGH the courtesy of Messrs. Mossay & Co., Ltd., of Westminster, we were recently enabled to make a brief trial of the capabilities of a 2½-ton Lloyd electric vehicle, which is representative of a type which has found particular favour on the Continent, being largely used by the German and other Postal authorities, municipalities, hospitals, and for heavy industrial purposes, and passenger vehicles. The constructional features embodied in these vehicles are the result of a good many years' experience, and are of particular interest in view of the attention given to detail.

The method of driving is worth noting. Two high-speed totally-enclosed compound-wound motors are geared to the front wheels, the motors being bolted to the front axle in such a manner that the pivot about which the wheels turn when steering lies vertically over the point of contact between the wheels and the road, and as a consequence shocks between the wheels and the road are not transmitted to the steering wheel, and the steering is surprisingly easy. Moreover, in case of need, the car can be driven by one motor alone without effect on the steering.

Removable end shields are provided at the commutator ends of the motors; the armatures run in ball bearings, and thrust bearings are provided to take the horizontal pressure on the pinion, which is provided with spiral teeth.

The gears are of nickel steel, and run in aluminium dust-proof casings, and strong ball bearings are fitted to all the road wheels.

Tudor batteries of 40 cells for light and 80 cells for heavy vehicles, are fitted, being in the ordinary way slung under the chassis by means of hooks; a small winch is provided for hoisting the battery into position from a trolley, which can be run under the chassis. A change of battery can be made in four minutes.



2½-TON CHASSIS, SHOWING GEARED FRONT-DRIVE MOTORS, CONTROLLER, &C.

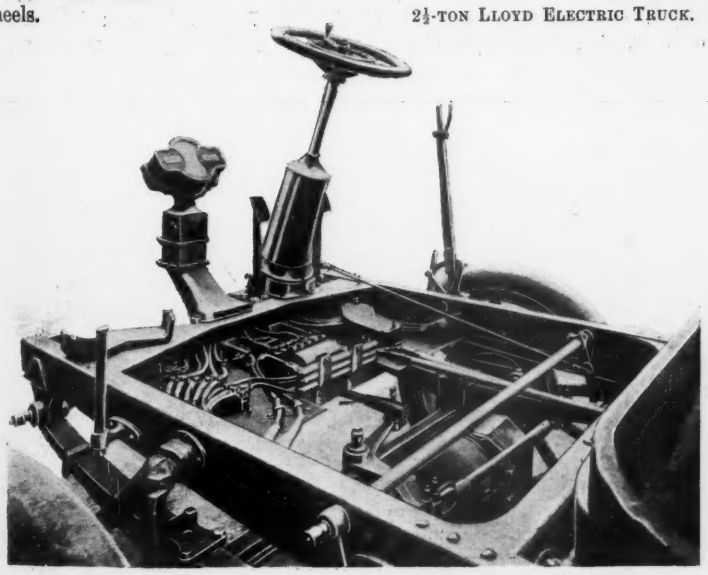
2½-TON LLOYD ELECTRIC TRUCK.

The controller is interesting, the drum being hollow and mounted coaxially with and enclosing the steering pillar, with the controller handle mounted concentrically above the steering wheel.

Normally, the controller is provided with an "off" position, five forward running positions, one reverse and one brake position. It is possible to inspect the drum contacts by slipping off the metal cover, which is slightly conical, and makes a watertight joint when on its seating.

The starting resistances and a small drum controlling them are situated under the driving seat, and the switching is effected by the left pedal; with this drum four resistance steps can be inserted in each position of the main controller by allowing the pedal to rise slowly, and the current may be interrupted on each step of the main controller by pressing the pedal right down.

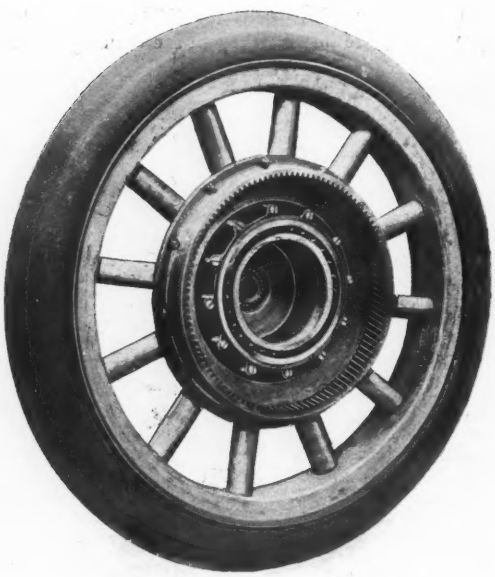
When driving the car, the pedal is used to cut off the current before each motion of the main controller, and subsequently to introduce the four resistance steps, so that no sparking takes place on the main controller, and the insertion of the resistance steps causes the passage



2½-TON CHASSIS; VIEW OF WIRING BETWEEN CONTROLLERS AND MOTORS.
Covers of one disconnecting box and auxiliary controller removed.

from step to step of the main controller to be extremely gradual and free from current rushes.

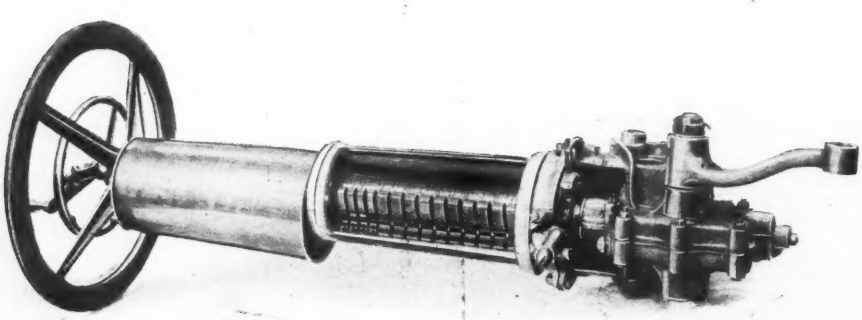
Thus controller wear is practically confined to the small



Front Wheel, showing Spur Gearing.

resistance controller, and maintenance in this direction is a minor item of expense.

The wiring is simply arranged under the driver's foot-



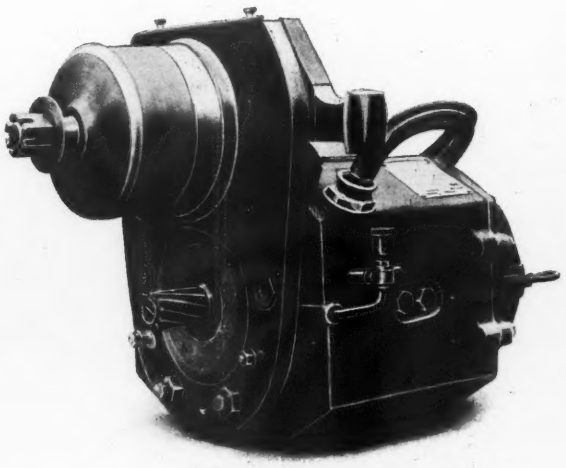
Steering-Control Pillar, showing Controller Cover Removed.

board, the controller and motor leads being coupled in distributing boxes, which give every facility for disconnection, and owing to standardisation of nuts, &c., involves the use of a minimum of tools. A pedestal in front of the driver carries a combined volt and ammeter, also a contact plug, the removal of which by the driver disconnects the motor circuits; the plug can be used for charging the battery without removing the latter from the vehicle. Electrical braking is provided on the front wheels and two mechanical brakes on the rear wheels.

A feature of the Lloyd vehicle is its front driving, and the high efficiency of the motors employed, which it will be noticed, are geared down (about 10 to 1) on to the wheels.

The electric vehicle uses one of the cheapest forms of power obtainable, and in other ways it lends itself to cheap operating costs, viz., the maintenance of the electric equipment is confined to replacement of controller fingers, ball bearings, brake linings, &c., truing up armatures; and the battery, by arrangement with the makers, can be maintained on a mileage basis.

Tire wear is much reduced, owing to the easier running and starting conditions, and many tire manufacturers



Motor with Pinion and Front-Wheel Hub, Lloyd Electric Vehicle.

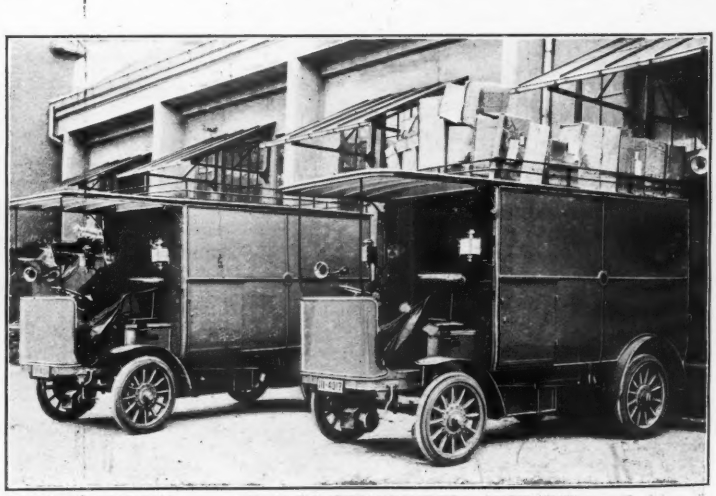
are prepared to guarantee 20 per cent. greater mileage than their normal figure for tires on electric vehicles.

Accident risk is low, because such vehicles are particularly easy to handle in traffic, and for obvious reasons fire risk is a negligible quantity.

Experience shows that running costs do not vary to any great extent over a period of years, and that 10 per cent. is a safe rate of depreciation.

A large Continental cab company has been using Lloyd electric vehicles for seven years, and the best testimonial to their efficiency in service is the fact that they have increased in number during that period from 25 to 115; it is further found that such vehicles can be used 350 days a year, which is in great contrast to the usual experience with petrol-driven vehicles.

We may add, in conclusion, that our illustrations show the essential features of the Lloyd vehicles, of which some 700 have been put into service, mainly in Germany, for both goods and passenger transport.



Lloyd Electric Vehicles Supplied to German Post Office.

ELECTRIC DRIVING AT THE CLEMENT-TALBOT WORKS.

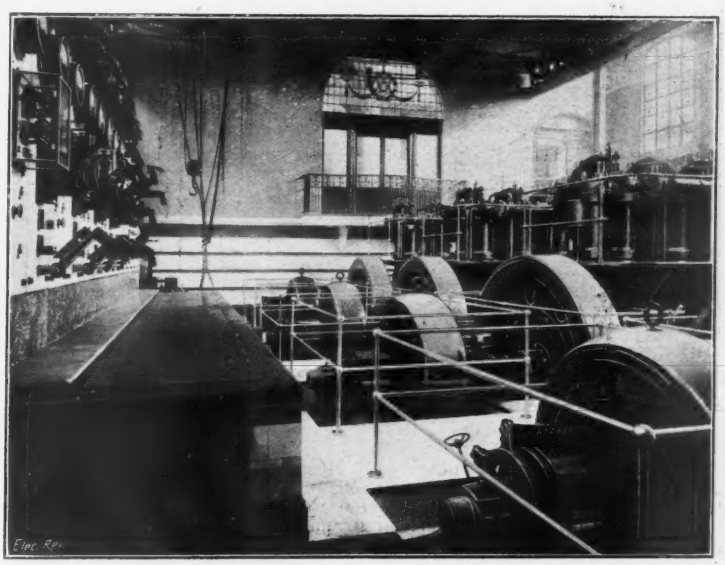
Amongst the numerous electrically-driven engineering works in this country, the well-known Clement-Talbot motor-car works at Shepherd's Bush, W., is an excellent example of its class. The works were started about 10 years ago, and designed, in the first instance, for electric driving from a works power station, and the arrangements then adopted represent the best practice for a works of this character at the present day.

The power station and offices are situated in a building separate from the works proper, the power station forming one wing adjoining the handsome entrance hall, from which it is visible through large windows, while the office block adjoins the entrance hall on the opposite side. Originally the works power plant consisted of vertical gas engine-driven generators working in conjunction with a Mond gas plant, but some three years ago this equipment was displaced in favour of Diesel engines.

At the present time four 200-B.H.P. four-cylinder Diesel engines, by Messrs. Mirrless, Bickerton & Day, driving 135-KW., 110-volt E.C.C. direct-current generators are installed in the engine room, in conjunction with a switchboard, supplied by the Adnil Electric Co., consisting of 15 marble panels, four pairs for generator control, six feeder panels and one for controlling a small gas engine-driven generator and a battery, either of which are available for office lighting or lighting pilot lamps in the works when the main plant is shut down.

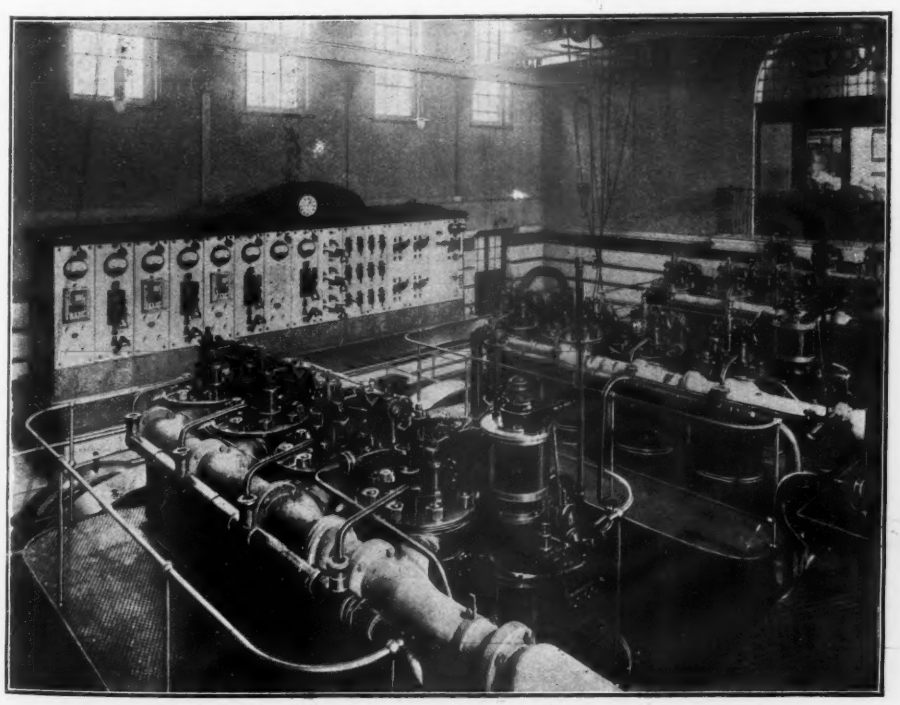
The battery is of the Tudor type, having a capacity of 100 amperes for ten hours, and is operated in conjunction with an Adnil booster giving a boost of from 5 to 55 volts. A special charging board for car ignition cells is provided in the battery room, where any work of this character required in connection with the firm's products is carried out.

A 25-ton fuel-oil storage tank is provided, from which the oil is pumped to two 200-gallon "ready-use" tanks for the immediate supply of the engines; the same oil is used for firing the heating boiler for the office building and for furnace heating in the works.



Main Switchboard, Diesel Engines and Generators, Clement-Talbot Works.

As day and night work is the rule in these works, the generating plant operates under very advantageous conditions, and the average load factor last year was, roughly, 50 per cent.; the output during the same period was 651,900 units, as compared with 444,800 units the year before, and the generating cost (labour, fuel and lubricating oil, repairs, &c.) amounted to ·442d. per unit, a figure which shows a substantial saving on that of the gas engine plant originally in use.



General View of the Engine Room, Clement-Talbot Works.

There are, in all, some 50 motors in use in the works, totalling approximately 610 H.P., as well as 140 semi-enclosed arc lamps and a number of incandescent lamps for lighting purposes, a usual peak load amounting to 3,500 amperes. It may be mentioned here that the motor equipment throughout has been supplied by the Adnil Electric Co., the arrangement of motor drive now in use being practically the same as that originally adopted by the firm's engineer at the suggestion of Mr. R. A. Marples, of the Adnil Co.

The machine tool equipment of the works consisting of numerous small machines, largely of the automatic type and adapted for repetition work, the group driving arrangement was naturally adopted; the various tools are grouped on to

cross shafting, each length of which is centrally driven by a motor, or if dealing with a heavy load, two motors are used, the shafting being split in the centre.

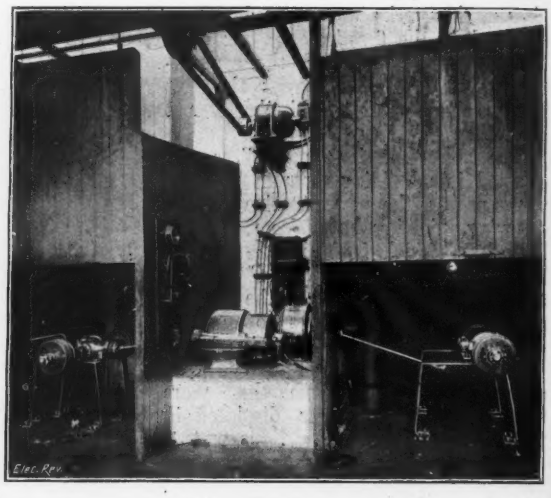
The motors are standard 20 and 40 H.P. machines running at, approximately, 1,000 R.P.M., and driving through belting on to the shafting which runs at from 160 to 235 R.P.M.

The shafting motors are carried in cradles suspended from the roof girders at about shafting level, and are controlled from the floor, through starting and main switches on opposite poles, attached to the nearest stanchion; a shunt ammeter is provided for each motor.

VIEW IN PLATING SHOP.

The various feeders from the main switchboard are laid in a special duct running centrally through the works and practically underneath the shafting motors; one main feeder supplies each shop through an ironclad distribution box, which is fitted with switch fuses and from which pairs of cables run through the cable duct to the stanchions carrying motor switches. All the cable is of the paper-insulated lead-covered type. In the smiths' shop a 10-H.P. motor is in use for driving the blower for the hearths, and a similar sized motor operates a swaging tool for drawing red-hot tubes for back axles, &c.

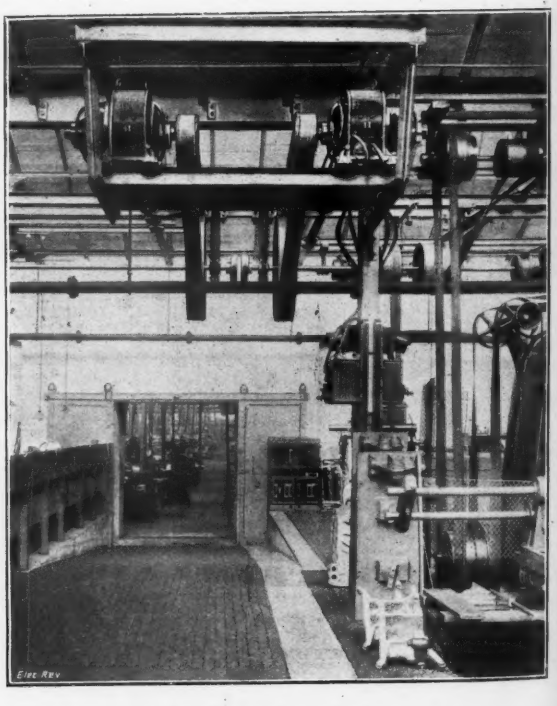
As previously mentioned, an annealing and hardening furnace is in use, fired with similar oil fuel to that required for the Diesel engine plant; this type of furnace is much more flexible, as regards temperature, than the usual gas-fired furnace. This, and the muffle furnaces, are coupled to a recording and indicating pyrometer, so arranged that a record of the temperatures of any three of the 10 pyrometer couples can be obtained, or by means of a selector switch a temperature reading of any particular couple can be obtained on an extra scale.



DIFFERENTIAL TESTING CABINETS, &C.

For the purpose of engine-testing, a 50-H.P. electric dynamometer by Hilare Huguet is installed as well as Froude water brakes. A special plant is required for the nickel, brass and copper plating of the numerous fittings which embellish the modern car, and this consists of a set of depositing vats, with a small motor-generator set for ordinary use, and two secondary cells for use during the dinner hour or when the works supply is shut down. Indicating instruments with pilot switches for each vat are

SINGLE MOTOR DRIVES.

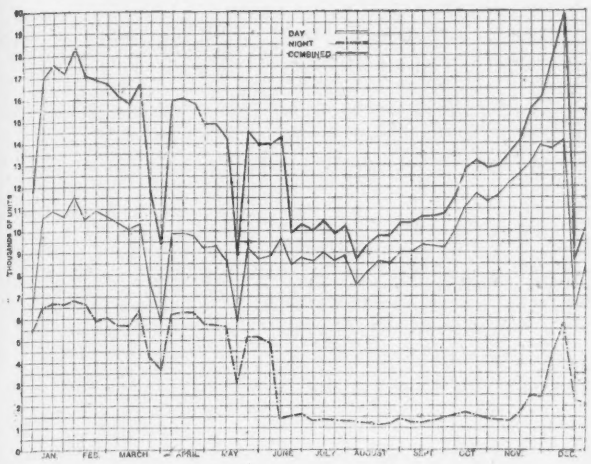


DOUBLE MOTOR DRIVE.

ELECTRIC DRIVING AT CLEMENT-TALBOT MOTOR-CAR WORKS.

provided, and the latter are each fitted with a dummy clock face, which can be set to any given time to remind the attendant when the plating process is completed.

Amongst other uses of electricity, one might mention the motor-driven ventilating plant for supplying heated air to



YEARLY LOAD CURVE DURING 1913; CLEMENT-TALBOT WORKS.

many of the shops, also the differential testing plants, consisting of two sound-proof chambers, in which differential gear can be run at high speed, driven through universal joints, by 15 and 10-H.P. motors respectively, placed outside the chambers.

The motor-controllers are inside the chambers, and it is possible to judge the tone of the running gear accurately at varying speeds.

A large number of electric hand drills are employed in erecting work, but will, we understand, be replaced by more robust compressed-air drills in the future, and in this connection two Sentinel air-compressors, each flexibly coupled to 60-H.P. Adnil motors, have been installed, compressed air being also employed largely in blowing out crank cases and motor fittings before erection, and in driving various pneumatic tools.

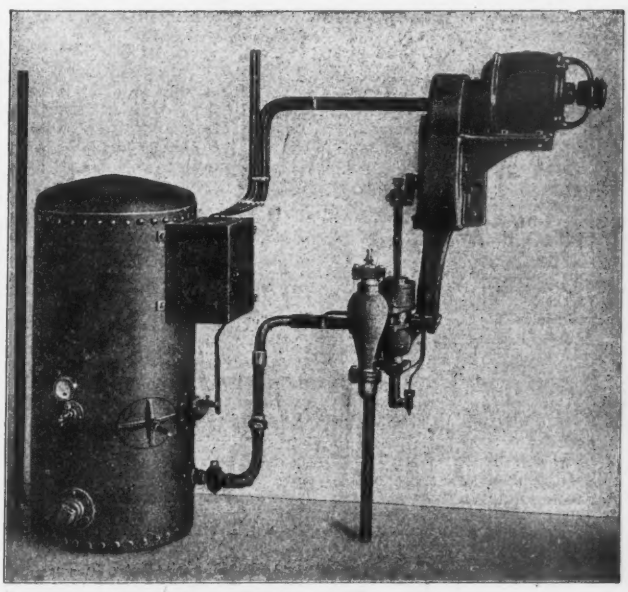
Some idea of the present size of the Clement-Talbot works can be gathered from the fact that between seven and eight hundred mechanics are constantly employed, but very large extensions are being built at the present time, and it is also contemplated to extend the engine room sufficiently to almost treble the present power plant.

In conclusion, we are indebted to Messrs. Clement-Talbot, Ltd., for permission to place on record the no small part played by electricity in the production of the well-known Clement-Talbot car.

THE USE OF ELECTRIC POWER FOR RAISING WATER.

IN a good many country houses and similar isolated positions, the supply of water is only available through the agency of a well, and it is frequently a troublesome matter to obtain a pure and abundant supply without a great deal of hard labour. Various means have been used to raise water in such positions, and in some of these electric power has been applied. One of the most ingenious pieces of apparatus of this description is that illustrated herewith, showing what is known at the "hydrobenoid," made by Messrs. Thiem and Towe, of Halle on Saale, Germany. It consists of a small electric motor which drives a combined water and air pump by means of raw hide gearing and a crank and connecting rod motion. By means of this, both water and air are drawn into the pump at the same time, and these are then pumped into a reservoir at a pressure of about three atmospheres. The motor is under the control of an automatic switch which is operated by the pressure of the water in the reservoir, and as soon as this reaches a certain value the motor is switched off automatically. If a certain quantity of water is drawn off from the outlet of the reservoir under pressure, the motor is automatically switched on again as soon as the pressure falls below a certain limit and the water and air pump again starts working.

The quantity of air which escapes from the reservoir with the water or in any other way, is replaced quite automatically by the air pump so that fresh air is always being conveyed, and the pressure remains constant. Hence the whole plant works automatically. The apparatus does not start working when a glass or so of water is withdrawn, but only when a larger quantity is withdrawn, so as to economise the amount of power used in pumping as much as possible. Moreover, the apparatus is so arranged that in the case of the electric power supply being disturbed, the work can be done by hand. The motors are specially arranged as regards insulation to withstand humidity of the atmosphere due to the presence of water, as for example when the apparatus is installed in the well itself. When the well is very deep, the motor with the combined water and air pump can, on account of its very small dimensions, be fixed in the well. An appara-



AUTOMATIC ELECTRIC PUMPING PLANT.

tus capable of giving an output of 330 gallons per hour at a height of delivery of 115 feet requires only ½ H.P. to drive it, the reservoir dimensions being 1¾ft. in diameter by 3½ft. high, ½in. pipe connections being used. For an hourly output of 1,100 gallons at the same height a 2 H.P. motor is used, the pipe connections are 2in. in diameter, and the reservoir measures 2¾ft. by 5½ft. high. The height of suction must not with a short well laid suction conduit, exceed 23ft. The apparatus is a well arranged and comparatively inexpensive one, which should recommend itself to private houses, factories, and even village and town supplies, where the ordinary methods of operation are not applicable.

Napier Tercentenary Celebration.—John Napier's classic work on logarithms was published in 1614; it is proposed to celebrate the tercentenary of this great event in the history of mathematics by a Congress, to be held in Edinburgh, on Friday, July 24th, 1914, and following days, under the auspices of the Royal Society of Edinburgh, the President and Council of which issue a general invitation to mathematicians and others interested to communicate with the general secretary, 22, George Street, Edinburgh.

CONTRACTS CLOSED.

(*Continued from page* 184.)

London.—L.C.C.—The Stores and Contracts Committee recommends the acceptance of the following tenders for the supply of stores for 1914 :—For electric carbons, schedule 13, W. Geipel and Co., items 7 and 8 ; H. G. Mayer & Co., item 6 ; for telephone wire, schedule 16, Hooper's Telegraph and India-Rubber Works, Ltd., item 4 (*a* and *b*).

The Committee recommends the acceptance of the offer of Brotherton Tubes and Conduit, Ltd, for the supply of unenamelled steel conduits and fittings.

The Fire Brigade Committee recommends the acceptance of the tenders of the Leyland Motors, Ltd., for the supply of 12 motor fire engines at £865 each, for 11 motor escape vans at £640 each, and for a chassis for a motor instructional tender at £420 (including £20 extras). The Committee also recommends that Leyland Motors, Ltd., be allowed to sublet to the Bosch Magneto Co., Ltd., the supply of the magnetos for the fire engines, escape vans and tender, and to the Rees Roturbo Manufacturing Co., Ltd., the supply of the pumps for the fire engines.

The Fire Brigade Committee reports the receipt of the following tenders for the installation of electric light in the Cherry Garden Street Fire Station :—

Cox, Walkers, Ltd.	(recommended)	£94
Finch & Wheeler, Ltd.		108
Stegmann & Co.		114
Pinching & Walton		115
A. Hawkins & Sons		119

HACKNEY.—The B.C. Electricity Committee recommends that Messrs. Rice & Son, the contractors for the electricity sub-stations, be allowed to sublet the steelwork in the contract to the Aston Construction Co., Ltd.

BATTERSEA.—The B.C. is extending its contract with Callender's Cable and Construction Co., Ltd., for cables, &c., for a further period of 12 months.

WANDSWORTH.—The tender of Messrs. Philpot Bros. has been accepted by the B.C., at £46, for wiring the Rating and Cemeteries Offices in High Street.

New Zealand.—The following tenders have been accepted :—

Five tons binding wire, £455; ⅛ mile lead-covered cable, 312 pairs, £396; ¼ mile cable, 624 pairs, £665 ; 100,000 insulator bolts and cups, £2,079 ; 5,000 porous pots, £183.—P. R. Baillie & Co.
100 tons copper wire, 200 lb., £8,700.—Samuel Brown, Ltd.
100 tons galvanised wire, 150 lb. per mile, £1,261 ; 100 tons ditto, 200 lb. per mile, £1,211.—E. W. Mills & Co.
One mile cable, 104 pairs, £520; 1 mile cable, 26 pairs, £210; 2 miles cable, 78 pairs, £820; 1 mile cable, 52 pairs, £303.—Richardson, McCabe and Co.

DUNEDIN.—Corporation. The tender of Messrs. Laurence and Hanson has been accepted for the supply for two years of polyphase Isaria meters.—*N.Z. Shipping and Commerce.*

Norwich.—The T.C. has accepted the tender of Siemens Bros. Dynamo Works, Ltd., for a high-tension switchboard for the new alternator and rotaries, at £676.

Preston.—The following tenders are recommended for acceptance by the Tramways Committee :—

United Electric Car Co., Ltd.—Six car bodies and trucks, £3,324.
Dick, Kerr & Co., Ltd.—Electrical equipment of the new cars, £1,725.

Rawtenstall.—The Corporation on 22nd inst., accepted the tender of Messrs. Babcock & Wilcox, Ltd., for coal-conveying plant.

Southampton.—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., at £4,084, for a steam turbo-alternator. The list of tenders appeared in our last issue.

Walthamstow.—The tenders of Hollington Bros., Atkinson & Co., Ltd., and H. Lotery & Co., have been accepted by Walthamstow U.D.C. for an annual supply of uniforms to the tramways department.

Woolwich.—The B.C. has accepted the following tenders for supplies to the electricity works :—

Babcock & Wilcox, Ltd.—Bends, tees, &c., for feed piping for Globe Lane Works, £35.
Meehan & Sons, Ltd.—Exhaust steam piping, £93.
F. A. Daniel, Ltd.—Hand and power screwing machine, £28.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, February 2nd.—"A" Company. Technical instruction, 7 to 10 p.m.
Tuesday, February 3rd.—"B" Company. Technical instruction, 7 to 10 p.m.
Wednesday, February 4th.—Recruits only. Recruit instruction and technical instruction, 7 to 10 p.m.
Thursday, February 5th.—"C" Company. Technical instruction, 7 to 10 p.m.
Friday, February 6th.—"D" Company. Technical instruction, 7 to 10 p.m.
Saturday, February 7th.—Headquarters will be opened from 10 a.m. till 12 noon, for regimental business only.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Newcastle Students' Section).—Monday, February 2nd. At 7.30 p.m. At Armstrong College. Paper on "Rectifiers," by Mr. A. E. Riordan.

Institution of Electrical Engineers (Scottish Local Section).—Tuesday, February 3rd. At 8.10 p.m. At Princes Street Station Hotel, Edinburgh. Paper on "British Practice in the Construction of High-Tension Overhead Transmission Lines," by Mr. B. Welbourn.

Royal Society of Arts.—Monday, February 2nd. At 8 p.m. At John Street, Adelphi. Cantor Lecture.
Wednesday, February 4th. At 8 p.m. Ordinary Meeting.
February 4th.—Paper on "Motor Fuels, with Special Reference to Alcohol," by Dr. W. R. Ormandy.
(Colonial Section).—Tuesday, February 3rd. At 4.30 p.m. Paper on "The Montreal, Ottawa and Georgian Bay Canal," by Sir R. W. Perks, Bart.

Institution of Civil Engineers.—Tuesday, February 3rd. At 8 p.m. At Great George Street, S.W. Paper on "The Problem of the Thrust Bearing," by Mr. H. T. Newbigin.
Friday, February 6th. At 8 p.m. Students' meeting.

Rontgen Society.—Tuesday, February 3rd. At 8.15 p.m. At London Hospital, Whitechapel. Demonstration of Wilson Portable Coil Apparatus by Dr. Gilbert Scott ; visit to X-Ray and Electro-Therapeutic Departments.

Institution of Civil Engineers of Ireland.—Wednesday, February 4th. At 8 p.m. At Dublin. Ordinary meeting.

Batti-Wallahs' Society.—Wednesday, February 4th. Informal meeting.

Chemical Society.—Thursday, February 5th. At 8.30 p.m. At Burlington House, Piccadilly, W. Ordinary meeting.

Greenock Electrical Society.—Friday, February 6th. At 7.45 p.m. At Temperance Institute, West Stewart Street. Papers on "Cinematograph Supplies," by Mr. W. B. Smith, and "Faults in House Wiring," by Mr. McGibbon.

NOTES.

A Hard Case.

I HAVE to sing a sorrowful song,
Of the woes of a shift engineer,
For he works very hard, and he works very long,
So his life's not all skittles and beer.

For this he receives a munificent wage ?
It's size is, in fact, microscopic ;
And his chief falls at once in a terrible rage,
If he broaches this horrible topic.

He's always alert, he mustn't sit down,
His nerve must be stiff as a poker ;
That's all very fine, but when pay-day comes round,
He mostly gets less than the stoker.

"Why were the volts down at eight last night ? "
No use saying "Bad coal," or "That rotten condenser,"
"You're not here to talk, but to make things go right "
(I delete the expletives, through fear of the Censor).

All the long night watch his vigil he keeps,
I hope none will ask me the question,
If ever he makes himself snug, and then sleeps ?
'Tis a cruel, and unworthy suggestion.—K.W.

Tungsten Lamp Improvements.—A paper by Messrs. Ward Harrison and Evan J. Edwards, recently read before the American Illuminating Engineering Society, provides an interesting *résumé* of the various improvements which have been made in the tungsten lamp since 1908. The earliest tungsten filament lamps were so fragile that their performance was judged almost entirely on total life figures. The introduction of the Mazda drawn-wire lamp in 1911 gave a filament with a strength 300 per cent. greater than that of the first tungsten lamp. The Mazda filament of to-day is approximately 40 per cent. stronger than in 1911. That this is actually the case has been proved by a series of transverse tests on filaments made in each year since 1907. The present drawn-wire filament can be deflected between 10 and 12 times as much as the pressed filament of 1907 without breaking. Candle-power maintenance has been improved by the introduction of a chemical into the bulb of the modern Mazda lamp. This chemical combines with the black deposit, and renders it light in colour, thus reducing the bulb absorption to a marked degree. At the present time all lamps above 40-watt size are supplied with the chemical. The cost of manufacturing and handling the lamps varies almost directly with bulb size, upon which the cost of reflectors and accessories is also dependent. There has been a general decrease in the size of Mazda bulbs. The actual dimensions of the bulb, cap and filament, and their relative positions, have also been standardised to accord as nearly as possible with the requirements of the illuminating engineer.

Local Government Board's Sanction for Loans.—We have received the following communication, dated January 27th, from Mr. H. Faraday Proctor, hon. secretary of the I.M.E.A. :—

"The Council of the I.M.E.A. at its last meeting had under its consideration a communication from the British Electric and Allied Manufacturers' Association, wherein it was pointed out that cases had occurred where local authorities had requested contractors to accept contracts subject to the sanction of the Local Government Board being obtained to the necessary loan, and had requested the contractors to proceed with the work prior to the receipt of such sanction. The I.M.E.A. has agreed with the B.E.A.M.A. that such procedure imposes an unfair liability upon contractors, unless the local authority in question undertakes to recompense the contractor for any 'work' so carried out at its request in the event of the contract not being entered into ultimately. The Councils of the respective associations have, therefore, agreed that their members should be advised to act in conformity with the foregoing arrangement."

Standard Symbols and Abbreviations.—Our contemporary, the *Elektrotechnische Zeitschrift*, announces that henceforward the nomenclature and notation—units and symbols—now agreed upon internationally will be used in its columns, and the hope is expressed that contributors will do their best to conform with these conventions. Confusion will thus be avoided, and the difficulty of following mathematical expositions will be reduced materially. A little inconvenience may be experienced in changing one's code of symbols, but this inconvenience is one to which practically every technical writer has in the past subjected his readers; the change is now to be made once for all. Certain symbols have already been fixed upon, and others will be determined at future meetings of the International Electrotechnical Commission. The symbols already adopted are reproduced below; they have been selected as offering the best compromise to the more or less conflicting requirements of various languages and applications, and once adopted, they must be retained loyally by all parties if the object of their selection is to be secured.

As the unit of power, it is recommended that the *kilowatt* be used instead of the *horse-power*, but it should be made clear that current consumption or output is not meant when purely mechanical power is concerned (for instance, the power of a water turbine driving a generator should be specified as so many kilowatts on the turbine shaft).

The following abbreviations for metric units are self-explanatory:—

Length: m., km., dm., cm., mm., μ (= 0·001 mm.).
Area: a., ha., $m.^2$, $km.^2$, $dcm.^2$, $cm.^2$, $mm.^2$.
Volume or capacity: l., hl., dl., cl., ml., $m.^3$, $dcm.^3$, $cm.^3$, $mm.^3$.
Mass: t., kg., g., dg., cg., mg.

The A.E.F. (Ausschusse f. Einheiten u. Formelgrossen) recommends the Siemens (S) as the unit of conductivity, and this will be among the suggestions considered by the I.E.C. at San Francisco in 1915.

For obvious reasons, units must be written in full in formulæ, or, at any rate, not so far abbreviated that there is any risk of confusing them with the symbols of the formula itself.

Length	l	Specific heat	c
Mass	m	do. at constant pressure	c_p
Time	t	do. at constant volume	c_v
Radius	r	Coefficient of thermal expansion	α
Diameter	d	Magnetic strength ...	$\mathfrak{H}$
Wave length	λ	Strength of magnetic field...	$\mathfrak{H}$
Capacity, volume ...	v	Magnetic induction (density)...	$\mathfrak{B}$
Angle, arc	α, β	Permeability	μ
Angle of lead, phase displacement	ϕ	Susceptibility	χ
Velocity	v	Electromotive force ...	E
Acceln. due to gravity	g	Quantity of electricity...	Q
Angular velocity ...	ω	Self-induction	L
Revolutions in unit time	n	Electrostatic capacity ...	C
Efficiency	η	Electric current... ...	I
Pressure	p	do. resistance ...	R
Modulus of elasticity ...	E		
*Temperature, absolute	T		
do. above freezing	t		
Quantity of heat ...	Q		

* If confusion is liable to arise with the *time* symbol, use θ for absolute temperature and δ for temperature in ° C.

It will be noted that there is no accepted symbol for frequency. We have often pointed out the objections to the use of the symbol ~ in formulæ, &c.; the chief are these: that it is indiscriminately employed for "cycles" and for "cycles per second"; and that while it can be seen, and may perhaps be understood correctly, it cannot be read aloud—a fatal defect. No other quantity in the whole range of practical engineering is ever represented in a formula by a symbol that has no name.

Engineering Labour Dispute.—The daily Press states that a dispute has arisen at Barrow between Vickers, Ltd., and the Amalgamated Society of Engineers. The men have demanded an increase in wages of 6s. per week, and the employers offer 2s., but their concession has been rejected by a majority of the men.

Continuity of Supply.—After our "Correspondence" columns were closed, the following letter came to hand:—"In your last issue under the heading of 'Continuity of Supply,' there appears a letter signed by 'Shift Engineer,' which refers to the Bury undertaking as one of the concerns paying shift engineers about 10s. per week less than is paid at similar stations for the same class of work.

"I am closely acquainted with the wages and salaries of the different grades of men employed in other provincial towns, and have no hesitation in saying that our scale is above, rather than below, the average for undertakings supplying a maximum load of less than 3,000 KW. For the information of your readers, I give herewith the scale which applies to the engineers engaged on shift work:—Shift engineer (power station), 45s., rising to 50s. per week; ditto (sub-station), 37s. 6d., rising to 42s. 6d. per week; juniors, 32s. 6d., rising to 37s. 6d. per week. The juniors act as assistants to the shift engineers at the power station. The average hours per week vary from 51 to 53.

"Your readers have at least the right to expect that correct information should be placed before them, and even assuming that 'Shift Engineer' is one of the downtrodden few, he should make sure of his facts before he places the shift engineers in any other town in the same category as himself.

"S. J. WATSON.

"Bury Electricity Works,
"*January 27th*, 1914."

Electrical Rectification and Ageing of Alcoholic Beverages.—The improvement and sterilisation of articles of food by the aid of electricity has been the subject of many more or less successful experiments. Recent progress in its practical application to wine manufacture, as described in *L'Electricien*, gives promise of further important developments.

Such spirituous liquors as are commercially manufactured usually contain other organic compounds, particularly aldehydes, which impair the taste, and even render them unfit for consumption. Ordinary distillation not being entirely satisfactory as a method of purification, various attempts have been made to achieve the desired end by chemical or electrical means.

Naudin's method of electrolysis before distillation is based upon the formation of alcohol from the aldehydes by the action of hydrogen. In the perfected form of the process, the juices are passed through a perforated tube into a glass vessel containing a 1 : 1,000 solution of sulphuric acid. The electrodes are of platinum, and two cocks permit samples to be drawn off to judge the effect of the electrolysis. When this has been carried as far as desirable, the mixture passes into a vat containing just enough granulated zinc to neutralise the acid present. Rectification then takes place, the whole process being so economical as to obtain a commercial efficiency 15 per cent. better than that of simple distillation.

The action of ozone has been employed by three inventors:—Eisemann, whose method of oxidisation by means of ozone has never been used commercially; Broyer, who essayed an ageing process by repeatedly bubbling a stream of electrically-produced ozone through the liquid; and Pilsoudsky, whose experiments in Russia have led to a method of purification by a chemical action between the ozone and the liquor, the ozone being generated in the liquor itself. This process not only destroys the organisms of secondary fermentation, but assists the formation of the ethers which give bouquet to the wine, thus greatly improving inferior qualities, both as regards aroma and taste. It may be added that artificial wines deteriorate in this process.

For manufacture on a large scale (10,000 litres a day) the apparatus is generally as shown in fig. 1. The lower electrode E consists of a network of nickel-plated iron tubes provided with small nozzles *o* and carried on insulators *i*. From a cylinder R, oxygen

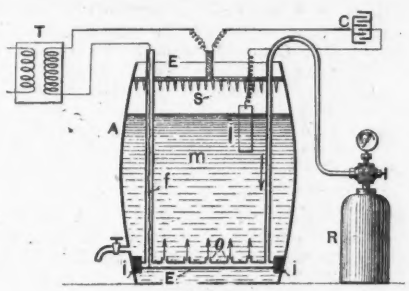


FIG. 1.

flows through the pipes, and passing through the electrically-charged liquid *m* is partly transformed into ozone. High-tension high-frequency current from a transformer T is applied to the two electrodes, the upper one E^1 being formed by a disk with pointed projections S, which act as sources of dark discharge. The condenser C, connected to an electrode I immersed in the liquid, merely serves to accelerate the process, which occupies a period varying from one hour for white wine to four for Madeira.

A much smaller apparatus is shown in fig. 2 and is designed for dealing with quantities up to 100 litres. The glass vessel A is

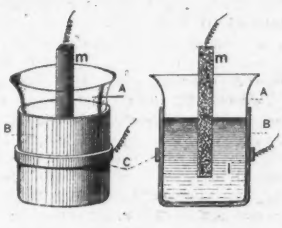


FIG. 2.

coated externally with lead foil B, and fitted with a metal band C, which is connected to one terminal of a high-frequency supply, the other terminal being connected to a rod of agglomerated or retort carbom *m*, which is inserted in the liquid *l*. The vessel thus becomes a true Leyden jar.

In conclusion, it may be added that among other liquids, oils are said to benefit greatly by subjection to this electrical treatment, five minutes sufficing to removing the acidity from rancid oil.

Depositing Nickel on Aluminium.—The electro-deposition of nickel on aluminium, a process hitherto impracticable, can be accomplished by a method described by Messrs. J. Canac and E. Tassilly in a note presented to the French Academy of Sciences; the deposit obtained is firmly adherent, and is unaffected by hammering or bending, or by raising to any temperature short of the melting point of aluminium.

Institution and Lecture Notes.—INSTITUTION OF ELECTRICAL ENGINEERS (MANCHESTER STUDENTS' SECTION).—This Section is holding a social evening on Thursday, February 12th, at the Technical Schools, Old Trafford. There will be a whist drive from 7.30 to 10 p.m., followed by refreshments and a dance until 1.45 a.m. Will former Students communicate with the hon. secretary, Mr. A. T. Robertson, 240, Ayres Road, Old Trafford, Manchester? The prices of the tickets are:—Ladies, 3s.; gentlemen, 3s. 6d.; double tickets, 6s.

At the meeting of the MANCHESTER LOCAL SECTION on Tuesday last a paper was read by Mr. T. Ferguson, on "Electric Train Lighting Systems." The discussion was closed.

Sir Oliver Lodge's Kelvin Lecture before the I E E., on Thursday last week, dealt with the electrification of the atmosphere in connection with its bearing on the weather (which, he thought, might be amenable to electrical control) and on the growth of crops. A report will appear in a later issue.

POST OFFICE TELEPHONE AND TELEGRAPH SOCIETY OF LONDON.—The January meeting took place at the Institution of Electrical Engineers on Monday last. A paper on the subject of the repair of telegraph and telephone apparatus was read by Mr. G. F. Mansbridge of the Post Office Stores Department.

SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS.—Last month the annual dinner of the Institute took place, and was attended by the Governor-General, Lord Gladstone, and the Minister of Mines. Mr. Bernard Price occupied the chair, in the absence of the President, Mr. J. W. Kirkland.

ASSOCIATION OF MINING ELECTRICAL ENGINEERS.—The monthly meeting of the West of Scotland Branch was held on Saturday last at Glasgow. Arrangements were made for a social gathering in connection with the branch to be held towards the end of next month. Mr. J. R. Laird, electrical engineer with the Oakbank Oil Co., Mid-Calder, gave a lecture on "Wireless Experiments," illustrated with practical demonstrations.

NOTTINGHAM ENGINEERS AND WORKS MANAGERS' ASSOCIATION.—This evening Mr. W. Dammond will lecture on the subject of signalling on railways, with special reference to his system of cab-signalling. On February 27th there will be a lecture on "Electric Filament Lamps."

Appointments Vacant.—An honorary radiographer is required to attend twice weekly at the City of London Hospital for Diseases of the Chest, Victoria Park; engineering and mechanical draughtsman for Stoke-on-Trent, Electrical Engineer's Department (£104); mechanician, electrical, age 25-40, for Nigerian Government (passage, free single quarters, £250); shift engineer for Warrington Corporation (47s. 6d.); junior switchboard attendant for Salford (26s.); assistant mains superintendent, for Darlington Corporation (30s.). Particulars are given in our advertisement pages.

City and Guilds of London Institute.—The Institute has now returned to Gresham College, Basinghall Street, E.C., which will be in future the address of its head office.

Dinners and Socials.—In view of the approaching marriage of Mr. J. Dawson Paul, director of the firm of Boulton and Paul, Ltd., Norwich, the whole of the employés were entertained on Saturday, January 24th, by the parents of the bridegroom (Mr. and Mrs. J. J. Dawson Paul) to a dinner and smoking concert. The festivities took place in the historic St. Andrew's Hall, Norwich, and during a thoroughly enjoyable evening opportunity was taken to present the bridegroom with a very beautiful silver salver, suitably inscribed. The presentation was made on behalf of the employés by four of the oldest workmen—who have a combined service of over 200 years—and one of their number in a few well-chosen words voiced the feelings of all those connected with the works, also of the staff at the London office, who were simultaneously entertained at the Trocadero.

The electricity and tramways departments of the Bexley Council held their first annual dinner on January 19th, Mr. H. P. Stokes, electrical engineer and manager, presiding. The guests included Councillors E. J. Reid and H. Smith, Mr. N D. Bruce, Dartford Tramways manager, and Mr. A. Davie, accountant. The chairman submitted the toast of "The Subscribers to the Dinner Fund," and Mr. Councillor Reid, in replying, remarked upon the very cordial relations which existed between the employés and the manager. A good programme followed, and included songs by Mr. M. Carroll and Shakespearean recitals by Mr. A. Bryan.

Several members of the staff of the electrical engineering department at the London and North-Western Railway Co.'s works at Crewe are being transferred to the Euston office of the department, and their northern colleagues have entertained them at a farewell dinner. Mr. L. W. Swainson (chief assistant, Crewe), who presided over the dinner, pointed out that the transference had arisen through requirements of the chief accountant in regard to stores and expenditure matters. Complimentary speeches were made, and the departing members were offered best wishes for their future success.

The apparatus department of Messrs. Siemens Bros. & Co., Ltd., at Woolwich, held a dinner at Freemason's Hall, Woolwich, a fortnight ago to-night, when Mr. F. Hird, manager of the department, presided over a company of over 200. A concert followed. The toast of "The Firm" was proposed by Mr. H. Dixon, and responded to by Mr. Hird, who, in the course of his remarks, referred to three employés who had been with the firm from 44 to 45 years without a break.

On Friday, 23rd inst., at the Clarendon Restaurant, Hammersmith, the staff and directors of Messrs. Evershed & Vignoles, Ltd., met for their first staff dinner. The chair was taken by Mr. S. Evershed, who, in responding to the toast of the firm proposed by Mr. F. Martin, gave an interesting account of the formation and history of the company. He mentioned that during the 20 years which it had been established the output had increased at least 10 times, and that the prospects for the future were extremely favourable to further developments. A concert given by members of the staff and arranged by Mr. H. Blundell followed, a very enjoyable evening being spent.

OLD CENTRALIANS.—The 16th annual dinner of the City and Guilds College Old Students' Association, will be held at the Trocadero Restaurant, Piccadilly Circus, W., at 7.30 p.m., Saturday, February 21st, and will be preceded at 6.45 by the annual general meeting. Dr. G. T. Moody, D.Sc., F.C.S., President of the Association, will take the chair. Tickets (price 6s. 6d. each) may be obtained by any old student of the "Central" from G. W. Tripp, 4, Fairfield Road, Charlton, Kent.

The London Trade Disputes.—The latest reports to hand as we go to press do not point to an early termination of the deadlock that has occurred in the London building trade. The men's organisation expresses itself confident of winning, and states that it has the assurance of the sympathetic support from other unions, whose men are working on jobs where hands have been locked out because they declined to sign the penalty undertaking put before them by the employers. The masters, on the other hand, say that the number of men who have signed the clause would "stagger the unions" (*Times*), and that there is no prospect of the building trade being brought to a dead stop as the stoppage has been confined to the large firms that are members of the London Master Builders' Association who have imposed the penalty clause upon their men. The workmen's representatives say that they will not now go back until they get other grievances redressed besides those that have formed the subject of the present discussion. They, however, say that they intend to resist to the utmost the Masters' attempt to destroy Trade Unionism, but they are prepared to give guarantees that any agreements that are entered into shall be carried out. This question of guarantees is of almost supreme importance in connection with any negotiations that may take place between the London Electrical Masters' Association and the Electrical Trades Union. The Union speakers on Tuesday asked what guarantee they had that undertakings given by the Masters would be adhered to, unless there was an organisation to negotiate with. It was strange to hear the question of guarantees raised from that side of the controversy, for it is notorious that agreements made by organisations of workers have been flouted again and again by the workers themselves. Well might one of the employers ask: "What guarantee do you give us?" Whether the L.E.M.A. and the E.T.U. can arrive at a reasonable working arrangement which shall assure a recognition of the sanctity of contracts remains to be seen. That really is the crux of the position.

The *Times* of yesterday states as follows on the electrical dispute:—

"Although the danger of an ultimate conflict between the masters and men in the electrical trade of London has not been entirely removed, it has been postponed indefinitely, with a prospect of a friendly settlement."

According to the *Financial Times*, however, "the Electrical Trades Union took its first definite part in the fight on Wednesday night. Forty-eight electricians were called out from Lyons's new hotel off Piccadilly, and to-day (Thursday) pickets have been placed at all jobs being carried out by the London Master Builders' Association or members of the London Electrical Masters' Association. By night nearly all Union electricians will probably be out."

Copper.—Messrs. Merton's statistical report for the first fortnight of January shows European stocks lower, but prices still out of accord with the apparent shortness of supply. English stocks were 384 tons lower on January 15th than on December 31st, French stocks 608 tons, European supplies 1,652 tons less, and European supplies including Germany and estimates, 1,952 tons less. American supplies to Europe for the fortnight were low, Spanish about average, Chile shipments under the average, Australian well up. Total deliveries were not up to the average, though, of course, these figures may be materially altered by those for the last fortnight. The stock in American producers' hands at the end of December shows a remarkable increase on the figure for November 30th, quite sufficient to explain the moderate price. The increase on the month given is 19,424 tons, bringing the total visible supply up to the respectable figure of 70,341 tons for the end of December, 1913, a figure which has not been approached since May last.

Dreams—or Facts?—The *Gas World* of January 24th quoted Sir W. Ramsay as saying that he "could imagine a carpet permeated by wires, through which was sent a current of electricity," and spoke of him as a dreamer, adding that it was difficult to conceive that a carpet of this character could ever be popular, "even with the cats." It may interest our contemporary—and Sir W. Ramsay—to know that the electric carpet is no dream, but a practical reality; it has been on the market since 1912, and there are at least two makers. Foot-warmers, bed-warmers, surgical heating-pads, &c., are also made in the form of flexible fabrics

The "Point Fives."—A meeting of this Association was held on January 16th at Tricity House, when the Chairman, Mr. A. H. Seabrook, read an address on the "Rateable Value Tariff for Residences." He mentioned his conviction, as a result of investigations, that the rateable value was superior to all other bases of primary charge, with the provision that where gas was not more than 2s. 6d. per 1,000 cb. ft., the secondary rate should not exceed ½d. per unit. The system was easy to understand; it avoided the inspections necessary with a connected-load basis of charge; lamps of improved efficiency did not affect it to the same extent as with the latter system; it was also easy to vary the percentage basis of the primary charge. With gas at 2s. 6d. per 1,000 cb. ft., electricity could well compete at 6d. per unit for residence lighting, but for heating and cooking under the same conditions, not much more than ½d. per unit could be charged.

It was possible to regard the rateable value system in two ways: First, to calculate the primary charge to cover investment costs and standing charges of the complete electric service to the house, the secondary ½d. rate representing running cost, plus profit, of units sold; and second, the primary charge, plus a few units at ½d., could be regarded as the charge for lighting the house, and the secondary regarded as the charge for additional business from other uses than lighting. He did not see that it was unfair to put the standing charges on the lighting, if it gave the consumer the right to use electricity for heating and cooking; if they were debarred from charging a high lighting rate—which the business would stand—they could not offer a low enough rate to get the heating and cooking business, which would benefit the community in general.

The selling price of a commodity was what it would fetch in the open market, and sales and profits depended on the efficiency of selling staffs. It was fair to assume that a man living in a comparatively highly-rated house could afford to pay more for electricity, as he did for water. People often criticised the low secondary charge, which at Marylebone was ½d. per unit, but the running costs due to the increased output were only about ·33d. per unit, and were decreasing.

An interesting discussion followed, in which it was agreed that the rateable value system was not applicable to business premises. Objection was taken to the suggestion that 6d. per unit was a competitive figure with gas, the chairman replying that this was so in his area; he disagreed that 1d. per unit for cooking was a competitive rate, as it would not show a sufficient advantage to induce an every-day use of electric cooking and heating.

On the question of the cooking load being superimposed on the lighting peak, the chairman pointed out that this was the usual fear, and was not justified. At Herstmonceux a 60-KW. plant dealt with a lighting load, on which during the past 12 months there had been superimposed a cooking load connection of about 75 KW., and yet the 60-KW. plant dealt with the whole of the maximum load.

Electrically-Heated Wheel Grips for Motorists.—To avoid the objections to winter motoring caused by numb hands, electrically-heated grips for steering wheels are being manufactured by the Motorist's Warm Grip Co., Marshall, Tex. These heated grips may be laced on to the steering wheel rim and are heated by energy from the battery or low-tension magneto. The consumption of energy is low, being about one-half that required for one pair of electric head-lamps. Flexible cords wound round the spokes of the wheel connect the grips with the battery and switch, which may be fastened to the dashboard.—*Electrical World.*

Iron and Steel Trade.—At the annual meeting of the North of England Iron and Steel Trades Conciliation Board, Newcastle-on-Tyne, on Monday, it was reported that the number of operatives was 3,800, as compared with 4,346, the reduction being due to the stopping of iron works and the Richmond works, and the withdrawal of a body of men at West Hartlepool. Mr. Cox (the men's secretary) said the swinging of the pendulum after the boom was not going to be so serious as it generally had been after other booms.—*Financial Times.*

Fatalities.—Whilst carrying out repairs at the electric generating station of the Burnley Co-operative Society on Friday afternoon, Arthur Uttley, a fitter, received fatal injuries. He was carried round a fly-wheel, and when extricated was found to have sustained a fracture of the left leg, and serious injuries to his head. He died a few minutes later.

At the inquest the evidence showed that he was sent to repair the engine, and he asked H. Entwistle, an assistant engineer, to turn on the steam, as he was ready for a trial. The wheel commenced to move, and the deceased was carried round and injured fatally. Entwistle said he thought the deceased must have forgotten that the steam was turned on. He (Entwistle) said he tried the valve about half an hour before the accident, and found it closed. A verdict of "Accidental death" was returned.

Resonance of the Third Harmonic.—In a note recently communicated to the French Academy of Sciences, Mr. Swyngedauw discusses the resonance of the third harmonic of three-phase alternators, and shows that if the design is such that resonance occurs when the neutral point is earthed, with a network of about 20 km. of cable, then to produce resonance with the same alternator having the neutral point insulated would require hundreds of kilometres of cable. The conclusion is that with the lengths and capacities of cables met with in practice, resonance of the third harmonic is practically impossible when the neutral point is insulated.

Distributing Pole with Self-Contained Transformer.—The Commonwealth Edison Co., Chicago, is preparing to make practical trial of a novel distributing pole with self-contained transformer, which is the invention of Mr. E. O. Schweitzer, chief testing engineer for the company. The feature of the design consists in placing a transformer of somewhat cylindrical form in the lowest section of a tubular steel pole, the high-tension leads to the transformer being brought in through the pole, either from below or from above, while a convenient distributing head is provided for the low-tension conductors.—*Electrical World.*

Coal Mine Explosions.—The Home Office has issued a circular calling the attention of owners of coal mines to the success which has been attained in preventing explosions of coal dust by the addition of at least 50 per cent. of incombustible dust, and urging them to take steps to adopt the system, without waiting until the statutory regulation in which it will be included is issued.

Radium in U.S.A.—An American millionaire, said to be Mr. H. Phipps, has offered a gift of £3,000,000 for the foundation of 20 radium hospitals throughout the United States for the free treatment of cancer and other diseases. Mr. J. M. Flannery, president of the Standard Chemical Co., of Pittsburg, states that there is enough radium in Colorado to supply all the world's cancer victims five times over; radium now costs £48,000 a gramme, but he is prepared to supply to the American Government in the course of five years 200 grammes at £16,000 a gramme.

Inquiry.—Makers of an electrical prober, worked in conjunction with a portable telephone, for determining the existance of metallic deposits in mines, are asked for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—West Ham T.C. is being recommended to grant the following increases to its employés in the tramways and electricity departments:—Tramways department:—H. M. SCOTT, claims superintendent, from £190 to £210 per annum, and subsequently by annual increments of £20 to £250; G. E. GRIFFITHS, correspondence clerk, from £120 to £150 per annum, by annual increments of £15. Electricity department:—J. LAYTON, senior engineer on watch, 65s. to 70s.; A. J. GIFFEN, do., 60s. to 65s.; W. BRIDGER, do., 55s. to 60s.; W. SPITTLE, do., 55s. to 60s.; F. W. MALLETT, assistant engineer on watch, 30s. to 35s.; H. A. CHANDLER, do., 30s. to 35s.; H. LONDON, do., 30s. to 35s.; W. COBB, station foreman, £195 to £208; R. MANDER, draughtsman, 40s. to 55s., and to be designated senior draughtsman; W. F. EDGERTON, assistant sales manager and meter superintendent, £265 to £285; J. TURTLE, assistant wiring and lighting superintendent, £117 and commission to £130 and commission, and to be designated senior lighting and wiring superintendent; S. GOVER, heating and cooking representative, £2 per week and commission, to £156 per year and commission, and to be designated heating and cooking constructional superintendent; J. H. EADES, senior draughtsman, £125 to £140, and to £150 in January, 1915; A. GEORGE, assistant draughtsman, 20s. to 22s. 6d.; W. LEECE, district foreman, £150 to £165; L. W. PERRYMAN, public lighting foreman, £140 to £145. With reference to the salaries of the senior engineers on watch the increases proposed will exceed the limits of the Council's schedule, so that it is intended to raise the maximum to 80s., and the minimum to 60s. The same remarks also apply to the assistant engineers on watch, whose future maximum salaries will be 45s. and the minimum 35s.

The Barnes (Surrey) Council has appointed MR. W. CORNET as junior shift engineer at the electricity works at £150 per annum.

The Aldershot U.D.C. has increased the salary of MR. CHADINGBOWL, second assistant at the electricity works, to £104 per annum.

MR. W. R. ELLIOTT, station superintendent of the East Ham electricity works, is to have his salary increased from £210 to £220 per annum.

MR. T. F. LYNN has been appointed mains superintendent of the Walthamstow electricity undertaking at a salary of £150 per annum. This fills the vacancy caused by the resignation of Mr. Notley. An additional switchboard attendant is to be appointed at a salary of 30s. per week, rising to 35s.

The Oban T.C. Lighting Committee recently recommended that the salary of the electrical engineer should be advanced by £25 per annum.

MR. J. W. TURNER has been appointed deputy electrical engineer to the Huddersfield Council, at £230 per annum, rising by £10 increments up to £260.

MR. B. WESTALL, an engineer at the Darwen electricity works, has been appointed electrical engineer to the Burnley Co-operative Society. There were more than 100 applicants for the post.

MR. H. PARKER, second charge engineer at the Dover electricity works, has resigned his appointment, and, subject to the usual sanction, the junior charge engineer is to be promoted to fill the vacancy, at an increased salary of £94 4s. A new junior is to be

appointed at a salary of £78 per annum. It is also proposed to increase the senior charge engineer's salary, from April 1st next, to £125.

The members of the Aberdeen Corporation electricity works, at a smoking concert last Friday night, bade farewell to three of the staff, MR. J. A. V. THOMSON, who goes to Kinlochleven (British Aluminium Co., Ltd.), as engineer; MR. TRAIL, appointed engineer at Lossiemouth; and MR. DAVID S. ALLAN, leaving for Bengal. Mr. Bell, Corporation engineer, on behalf of the staff, presented each with gifts, and expressed the hope that they would be successful in their new spheres. The health of the three guests was drunk with musical honours.

Tramway Officials.—MR. C. W. BENTLEY, A.M.I.C.E., manager of the Musselburgh and District Electric Light and Traction Co., Ltd., having resigned, the position has been filled by the appointment of MR. ROBERT WATSON, late secretary of the company in London. MR. D. L. WINTER, Bo'ness Electric Tramway Co., has been appointed resident engineer.

General. — According to a financial paper, MR. WILLIAM F. HAMILTON, K.C., and MR. GEORGE A. TOUCHE, M.P., have been elected to the board of the Anglo-Argentine Tramways Co., Ltd., to fill the vacancies caused by the deaths of Mr. T. Frame-Thomson and Mr. E. A. Lazarus-Barlow.

MR. JOHN HOLLOWAY, works manager to Messrs. Jas. Howden and Co., of Glasgow, has been appointed to a similar position at the Whiteinch Works of the North British Diesel Oil Engine Works.

ALDERMAN JOSEPH CLIFTON, of Peterboro', chairman of the Electricity Committee, and an ex-Mayor of the borough, celebrated his 80th birthday on Tuesday. He was recently presented with some framed photographs of the buildings, plant and staff, by the employés, at a dinner.

MR. FRED PARLETT has joined Messrs. Isenthal & Co. as sales manager with a view of developing their heating and cooking business. He has lately represented the British Prometheus Co., Ltd., in a similar capacity, and has now severed his connection with them, after 10 years' service.

We regret to announce that owing to continued ill-health MR. BERNARD M. JENKIN, has decided to retire from his partnership in the firm of Kennedy & Jenkin. The partnership will be continued in future by the remaining partners (Sir Alex. B. W. Kennedy. Mr. J. M. Kennedy and Mr. S. B. Donkin) under the name of Kennedy & Donkin.

On Monday night last week at the works of Messrs. E. Brook, Ltd., Huddersfield, a presentation was made to MR. ERNEST BROOK, the head of the firm, to commemorate the making of the 10,000th motor to which we alluded last week. The presentation was subscribed for by the employés, and took the form of a smoking cabinet and spirit flask, suitably engraved. The presentation was made by Mr. Walter Vaughan, the oldest employé, who expressed the employés' pleasure in giving this testimonial as a mark of their appreciation. Mr. Brook suitably responded. The proceedings terminated with a vote of thanks to Mr. Walter Vaughan.

Obituary.—MR. W. CLEARY.—The death occurred on January 20th, at 18, East Avenue, Barnage Lane, Levenshulme, of Mr. Wm. Cleary, who had for 34 years been on the Manchester District staff of the National Telephone Co., and later with the Post Office Engineering Department. He was in his 52nd year.

The well-known Austrian professor and designer, DR. ING. KARL PICHELMAYER, who was for many years at the Technical High School at Vienna, passed away quite suddenly on January 23rd last at the early age of 45 years. He was a very valued member of the Electrotechnical Commission.

We regret to state that MR. W. G. WICKEN, who retired in September last from the position of manager of the composing department of the ELECTRICAL REVIEW, after serving faithfully in that capacity for 30 years, passed away on Monday last.

NEW COMPANIES REGISTERED.

Pirelli-General Cable Works, Ltd. (133,461).—Registered January 20th, by F. Samuelson, Midland Bank Chambers, 71A, Queen Victoria Street, E.C. Capital, £200,000 in £5 shares. Objects: To carry on the business of manufacturers of, and dealers in, india-rubber, gutta-percha and asbestos articles, insulating materials, india-rubber, gutta-percha, insulated and other wires and cables capable for use for telegraphic, telephonic, electric lighting and the conveyance of electricity, electricians, engineers, shipowners, shippers, &c., and to adopt agreements (1) with Pirelli & Co., (2) with Pirelli & Co. and the General Electric Co., Ltd., and (3) with Pirelli, Ltd., the General Electric Co., Ltd., and Pirelli & Co. The signatories (with one share each) are:—P. Pirelli, 18, Vic Ponte Seven, Milano, Italy, manufacturer; H. Hirst, 67, Queen Victoria Street, E.C., manufacturer. Private company. The first directors (to number not less than two or more than 10) are H. Hirst (vice-chairman), M. Railing and E. G. Byng, all of 67, Queen Victoria Street, E.C. (appointed by the General Electric Co., Ltd.), and P. Pirelli and A. Pirelli (chairman), of Milan, and H. Bevis, of 144, Queen Victoria Street, E.C. (appointed by Pirelli & Co., of Milan); qualification (except first directors), 200 shares; remuneration (except managing director) as fixed by the company. Registered office, 144, Queen Victoria Street, E.C.

Aeromin Promotion Syndicate, Ltd. (133,471).—This company was registered on January 21st, with a capital of £8,333 in £1 shares, to carry on the business of winners, refiners and workers of metals, mechanical, electrical and general engineers, metallurgists, smelters, &c., and to adopt agreements (*a*) with the Aerometal Syndicate, Ltd., and (*b*) with G. W. Sessions. The subscribers are:—G. D. Mackay, 100, Victoria Street, Westminster, manufacturer, one share; G. W. Sessions, 15, Copthall Avenue, E.C., international negotiator, one share. Private company. The directors are to number not more than three. G. W. Sessions is the first managing director. Registered by Bristows, Cooke & Carpmael, 1, Copthall Buildings, E.C.

Carleton Electrical Co., Ltd. (133,501).—This company was registered on January 22nd, with a capital of £20,000 in £1 shares (10,000 preference), to take over from G. Inrig, L. Inrig & Gavan Inrig, Ltd., their respective interests in the English and foreign patent rights of certain inventions for improvements in dynamo-electric generators, controlling continuous-current reversible dynamo-electric machines, the generating and control of electricity for lighting trains and other vehicles, apparatus for lighting and starting motor vehicles, internal-combustion turbines, motor-car lamps, &c. The subscribers (with one share each) are:—G. J. Mills, Southern Road, East Finchley, N., gentleman; G. Inrig, 154, Bishopsgate, E.C., consulting engineer. Private company. The number of directors is not to be less than two or more than seven; the first are G. Beeching, G. Inrig, G. J. Mills, A. Braid, W. S. Duffus and G. F. Beeching (all permanent); qualification, £1; remuneration as fixed by the company. Registered office, 569, Garratt Lane, Earlsfield, Surrey.

Weston's, Ltd. (133,469).—This company was registered on January 20th, with a capital of £5,000 in £1 shares (2,000 8 per cent. participating preference) to acquire an exclusive licence or sub-licence for the sale in the United Kingdom of primary batteries, and lamps manufactured under certain patents relating to, or capable of being applied thereto, and to adopt an agreement with A. W. Pask. The subscribers (with one share each) are:—C. A. Hampton, 9, Dayton Grove, Peckham, S.E., clerk; H. H. Cooper, 30, Manor Road, Leyton, accountant. Private company. The number of directors is not to be less than two or more than five; the first are not named; qualification, £100: remuneration, £100 each per annum (chairman £150). Registered office, 104, Wool Exchange, E.C.

British Steam Turbines, Ltd. (133,446).—This company was registered on January 20th, with a capital of £5,000 in £1 shares, to carry on the business of engineers, ship and boat builders, manufacterers of propellers and machinery, &c. The subscribers (with one share each) are:—P. A. Dunderdale, Dashwood House, E.C., engineer; R. F. Collinge, New Broad Street House, E.C., engineer. Private company. The number of directors is not to be less than two or more than five; the first are P. A. Dunderdale and R. F. Collinge; qualification, £100; remuneration, £59 per annum divisible. Registered office, New Broad Street House, E.C.

Superposed Currents, Ltd. (133,520).—This company was registered on January 22nd, with a capital of £5,000 in £1 shares, to carry on the business of electricians, mechanical engineers, machinists, fitters, founders, wire drawers, &c. The subscribers (with one share each) are:—G. R. Neilson, 112, Tulse Hill, S.W., secretary; A. C. Brown, 7, Queen's Square, Finsbury Avenue, E.C., electrical engineer; G. N. G. Tucker, Homeleigh, 109, Lordship Road, Stoke Newington, N., printer: G. C. Jack, Riversdale, 21, Oxford Road, Putney, S.W., accountant. Private company. The number of directors is not to be less than three or more than five; the first are G. R. Neilson (permanent managing director and secretary, subject to holding 100 shares), A. C. Brown, G. N. G. Tucker and G. C. Jack. Registered office, 7, Queen's Square, Finsbury, E.C.

Ernest Wood, Ltd. (133,503).—This company was registered on January 22nd, with a capital of £1,500 in £1 shares, to carry on the business of electrical engineers and contractors, &c., and to adopt an agreement with E. Wood. The subscribers (with one share each) are:—T. Beswick, Station Yard, Knutsford, director; E. Wood, Bank Field, Grove Lane, Hale, director. Private company. The number of directors is not to be less than two or more than five; the first are T. Beswick and E. Wood; qualification, 50 ordinary shares. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

Marine Engine Auto Control Co., Ltd. (133,485).—This company was registered on January 21st with a capital of £5,000 in £1 shares, to acquire from A. Esplen the benefit of certain existing inventions in relation to the control of marine engines direct from the telegraph instrument. The subscribers are:—A. Esplen, 3, Redcross Street, Liverpool, consulting engineer, one share; M. Glasgow, 3, Redcross Street, Liverpool, engineer, one share. Private company. The number of directors is not to be less than two or more than five; the first are A. Esplen and M. Glasgow (both permanent). Solicitor: A. S. Lloyd, 61, Lord Street, Liverpool. Registered office, 3, Redcross Street, Liverpool.

Alexandra Electrical and Engineering Works, Ltd. (133,472).—This company was registered on January 21st, with a capital of £500 in £1 shares, to take over the business of the Alexandra Electric Works, of 25, Station Road, Letchworth, to carry on the business of electric, gas and general engineers, gear cutters, automobile and general machinery agents, &c. The subscribers are:—Jack Oppermann, 25, Station Road, Letchworth, Herts., engineer, 100 shares; Mrs. Janet Oppermann, 25, Station Road, Letchworth, Herts., 100 shares. Private company. The directors are to number not more than two or more than five; Jack Oppermann is the first director; qualification, 50 shares. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Porous Accumulator Co., Ltd. (57,526).—Capital, £3,000 in £1 shares: return dated December 27th, 1913: all shares taken up; £1,007 paid, £1,993 considered as paid; mortgages and charges: Nil.

Oliver Arc Lamp, Ltd. (90,880).—Capital, £2,000 in £1 shares, return dated October 23rd, 1913; 1,407 shares taken up; £7 paid, £1,400 considered as paid; mortgages and charges: £15,000.

Railless Electric Traction Co., Ltd. (98,728).—Capital, £5,000 in 4,750 ord. shares of £1 shares, and 5,000 deferred shares of 1s. each; return dated January 5th, 1914; 9,571 ord. and 5,000 deferred shares taken up; £1 per share called up on 2,076 ord.; £1,916 paid, leaving £140 in arrears; £765 considered as paid on 615 ord. and 5,000 deferred; mortgages and charges: Nil.

Dynes Bros., Ltd.—A memorandum of satisfaction in full on January 15th, 1914, of debs., dated May 30th, July 4th, 1910, and August 9th, 1911, securing £3,000, has been filed.

Northern General Transport Co., Ltd.—Trust deed, dated December 30th, 1913, securing £150,000 deb. stock, with power to issue further stock ranking *pari passu* to an amount not exceeding (with certain stock to be held in reserve) the amount of the issued share capital of the company for the time being. Property charged (specifically): Certain shares in the Gateshead and District Tramways Co., the Tynemouth and District Electric Traction Co., Ltd., and the Jarrow and District Electric Traction Co., Ltd., respectively, already acquired by the company, and all other shares in the said companies that may be acquired by the company on or before January 31st, 1914. (As a floating security): The company's undertaking and property, present and future, including uncalled capital. Trustees: The Electrical and Industrial Investment Co., Ltd., Electrical Federation Offices, 1, Kingsway, W.C.

Harraway Bros., Ltd.—Particulars of £2,000 debentures, created January 15th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £800. Property charged: The company's undertaking and property, present and future, including uncalled capital (if any). No trustees.

Electra Rubber and Vulcanite, Syndicate, Ltd.—Issue on January 9th, 1914, of £50 debs., part of a series of which particulars have already been filed.

CITY NOTES.

Chatham and District Light Railways Co., Ltd.

THE directors report that for the half-year ended December 31st, 1913, the revenue was £25,880, and the expenses were £14,115, leaving £11,765, less rent of Rochester Corporation lines, £1,872; interest on debentures, £934; interest account, £345; leaving £8,613, plus £2,766 brought forward, making the balance £11,379. Of this amount £5,500 has been transferred to reserve for depreciation, and the directors recommend that the balance be disposed of as follows:—£2,940 to dividend at the rate of 5 per cent. per annum for the half-year on the preference share capital; £2,120 to dividend at the rate of 4 per cent. per annum for the half-year on the ordinary share capital; £819 to revenue new account. The traffic receipts show an increase of £1,884, and the expenses an increase of £839, as compared with the receipts and expenses for the corresponding half-year of 1912. During the year £12,900 debentures of the company were purchased and redeemed, and the difference between the purchase price and par value added to reserve for depreciation.

Half-year ended—	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No. of cars.
June, 1912	14·98	4,455,807	£21,570	1·16	544,512	45
Dec., ,,	14·98	4,850,273	£23,634	1·17	567,302	47
June, 1913	14·98	4,669,161	£22,713	1·17	540,192	47
Dec., ,,	14·98	5,210,322	£25,519	1·17	567,684	47

Lanarkshire Tramways Co.

THE directors' report for the half-year ended December 31st, 1913, says that the revenue for the period was £48,391, and the expenses were £26,456, leaving £21,935. From this are to be deducted:—Contributions payable to local authorities, £1,433; interest on debentures, £911; interest account, £580; interest account—Lanark County Council Tramways, £272; amounts written off, as per revenue account, £1,170; leaving £17,567, plus £7,093 brought forward, making the balance £24,661. Out of this amount £11,000 has been placed to reserve for depreciation, and the directors recommend that £11,147 be applied to dividend at the rate of 6½ per cent. per annum for the half-year, £522 to directors (10 per cent. of net profits after payment of 5 per cent. dividend), and £1,991 to revenue new account. The revenue shows an increase of £6,481, and the expenses an increase of £4,266 as compared with the revenue and expenses for the corresponding half-year of 1912. The directors have transferred £11,000 to reserve for depreciation, which, with interest credited to the reserve during the year, makes a total contribution of £13,357. An amount of £1,170 has also been written off as per revenue account. A dividend for the half-year at the rate of 6½ per cent. per annum is recommended, making 6½ per cent. for the year. The Lanark County Council tramways from New Stevenston to Bellshill, and Holytown to Mossend, were opened for public traffic during the half-year, and have been worked by the company under the agreement with the Lanark County Council. The construction of the line from Bellshill to Mossend has unavoidably been delayed, but the work is now completed and the lines will be in operation in a few days. The directors propose extending the motor-omnibus service, and will acquire additional omnibuses for this purpose.

Half-year ended—	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No. of cars.
June, 1912	23·32	7,062,726	£36,570	1·21d.	893,927	64
Dec., 1912	23·32	8,202,018	£41,367	1·21d.	955,164	64
June, 1913	24·62	8,579,876	£42,834	1·20d.	979,691	66
*Dec., 1913	34·29†	9,471,832	£47,760	1·21d.	1,074,440	78

* Includes motor-omnibus service.
† Tramways, 26·25 miles. Motor-omnibuses, 8·04 miles.

Yorkshire (West Riding) Electric Tramways Co., Ltd.

THE annual meeting was held on Friday last at the offices, 31, Throgmorton Street, E.C., Sir H. S. Leon, Bart., presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 150), said that the year under review had been a good one for the tramways. The weather was fine and trade had been good. Consequently the earnings from the business showed a very satisfactory and substantial increase which enabled the directors to pay an increased dividend upon the preference shares. £6,933 more had been earned over the previous year at an additional cost of £784, giving a net gain on the trading account of £6,149. During the year £20,091 had been expended on capital account. The most important item was the expenditure on the paving of the permanent-way of the Wakefield section. Altogether they had spent £34,376 in that connection, but there would have to be considerable further outlay in the near future upon the track between Nuneaton, Castleford and Pontefract. £3,769 had been expended on fitting the cars with top covers. The total capital expenditure to date was £770,186, and on the other side the amount over-expended was £58,996. That, however, by no means represented all the money that had been spent on capital over and above that subscribed, for the sums put aside for depreciation and reserve had all been utilised for that purpose. Since the tramways had been running no less a sum than £102,404 had been expended out of revenue on capital account. There could be no finality in capital expenditure with an increasing business such as he hoped they were going to have, and in order to popularise their cars it was essential to keep the plant, cars, &c., in such a state of efficiency as would only invite favourable criticism. Additional capital would be needed almost immediately, and when it was decided to make an issue the shareholders would be asked to subscribe. The new capital would be raised in the cheapest possible way; there would be neither commission nor underwriting, and if the shareholders did not care to subscribe, all the money required would be found by the board and their friends. During the year they had obtained a provisional order for lighting the town of Pontefract, and the company was now engaged in erecting the necessary plant for this undertaking, which would cost very nearly £12,000. From the lighting undertaking an immediate profit was certain as soon as the business was started. The board were not at all satisfied with the traffic between Normanton, Castleford and Pontefract, and they had in view a scheme for doubling the track which would enable them to run a more frequent service. That was a very big undertaking which would not be carried out this year, but they would endeavour to make all arrangements for doing it next year, provided, of course, that in the judgment of the board, the company would receive a certain profit therefrom. The total receipts averaged 9·938d. per car-mile compared with 9·081d. in 1912, an increase of 0·857d. The receipts per car-mile had steadily risen yearly from 7·036d. in 1905 notwithstanding the fact that the mileage run by their cars had increased from year to year. The working expenses were £33,341, an increase of £784. On a car-mileage basis it cost 4·47d. to run each car-mile, whereas in the previous year it cost 4·406d., an increase of 0·070d. per car-mile. That increase was brought about principally by a substantial increase of wages, which was granted to the men during the year, and to additional expenditure on cars. The percentage of expenses to receipts was 45·04, compared with 48·52 in 1912, a decrease of 3·48 per cent. As showing the progress of the company, he might mention that the receipts had risen from £38,051 in 1905 to £74,029 last year. The balance carried forward from the revenue account was £40,688. After paying debenture interest, income-tax, &c., there was a balance of £27,312. That, compared with a balance of £20,106 last year, was an increase of £7,205. They had not yet succeeded in obtaining the sanction of the Board of Trade to the abandonment of three unconstructed routes they had declined to build, nor had they obtained the release of the Parliamentary deposits, but it was hoped that the application now before the Board of Trade, which would be considered next month, would result in the moneys being released and an agreement being come to which would be satisfactory to the Board of Trade, the local authorities and the company, particularly as they had offered to run a motor-'bus service instead of constructing the light railways, and they had already ordered four motor-'buses for that purpose. The year had been a busy and an encouraging one, and the shareholders could contemplate with satisfaction the very substantial progress which had been made. In the early days of the company, when the prospects were anything but bright, the directors were repeatedly pressed to distribute the small surplus in dividends, but those who advocated that policy did not appreciate the fact that the business had to be created, and that only by the most careful management of the company's finances, would it have been possible to weather the few trying years before arriving at the present dividend-paying stage. The board could take credit that they thoroughly grasped the position, and refused to cripple the business to satisfy those who desired dividends before they were properly earned. It was true they had no money in the till at the present moment, but their assets had so much increased in value that they had sufficient credit to be able to command any capital required in reason. It could be reasonably anticipated that unless some catastrophe occurred the present dividend would be continued, and they might even look forward with some confidence to the full 6 per cent. being returned to the shareholders in the near future, perhaps even in the present year.

MR. B. NEWGASS seconded the motion.

The CHAIRMAN, in reply to a shareholder, said that the form in which the additional capital would be issued had not been absolutely settled, but more than likely it would be issued as before—in short term notes repayable at particular dates with semi-annual drawings. With regard to motor-'bus competition the board saw no reason to be alarmed. Of course they would carefully watch any competition in that direction, but it was almost impossible for motor-'buses to be run as cheaply as tramways.

The report was adopted.

Clontarf and Hill of Howth Tramroad Co.—The directors announce a dividend at the rate of 3 per cent. per annum and a bonus of 1s. per share; £274 is carried forward.

Marconi's Wireless Telegraph Co., Ltd.—According to the *Financial News*, an interim dividend of 10 per cent. is announced, payable January 31st.

Traction and Power Securities Co., Ltd.—The accounts of this company for 1913 show, according to the *Financial Times*, a net revenue, including £11,255 brought forward, of £41,530. After writing off £7,336 in respect of loss on realisation of investments and transferring £10,000 to investment reserve account, the directors recommend a dividend of 4s. 6d. per share, leaving £4,976 to be carried forward. During the period under review there has been returned to shareholders paid-up capital to the amount of £2 per share, and the issued capital now stands at £683,280.

Bahia Tramway, Light and Power Co.—At a meeting, held last Friday, the new contract with the Municipality of Bahia for the acceptance of municipal bonds at 84 in exchange for the existing bonds, was approved by the holders of the 5 per cent. 50-year first mortgage gold debentures.

Japan.—The last Japanese mail brings the financial results for the last half-year of a number of additional electrical undertakings in that country. The Kinugawa Water Power Electric Co. is declaring a dividend of 6 per cent. A net profit of £11,708 is reported by the Hakodate Water Power Co. Of this sum, £1,568 is being placed to reserve, £890 allotted to the directors and auditors, while the shareholders receive £6,625 in the form of a 10 per cent. dividend, the balance being carried forward. The net profit of the Ina Electric Tramway Co. amounts to £4,799. In this case, £302 is being placed to reserve, £100 is being granted to the directors, the shareholders receiving £2,730 in the form of an 8 per cent. dividend, leaving a sum of £1,667 to be carried forward. The report of the Keisei Electric Tramway Co. reveals a net profit of £3,673, out of which £2,400 is being paid to the shareholders as a 5 per cent. dividend, £618 is being placed to reserve, £100 awarded to the directors, leaving £555 to be carried forward. The available net profits of the Keihin Electric Tramway Co. amount to £15,730. Of this sum, £1,460 is being placed to reserve, £730 devoted to bonuses, and £12,112 goes to the shareholders as a 6 per cent. dividend. The amount to be carried forward is £1,428.

Smithfield Markets Electric Supply Co., Ltd.—The directors have declared a dividend at the rate of 2½ per cent. per annum; £780 is to be carried forward. This compares with 2½ per cent. in the previous year.

Westminster Electric Supply Corporation, Ltd.—A dividend at the rate of 10 per cent. per annum is announced for the half-year ended December 31st, making the total for the year 10 per cent., the same as for the previous year.

Stock Exchange Notices.—The Committee has appointed special settling days as under:—

Wednesday, February 4th.—Marconi's Wireless Telegraph Co., Ltd.—Further issue of 250,000 ordinary shares of £1 (issued at £2 5s. per share premium) fully and partly (£1 10s., being 10s. capital and £1 premium) paid, Nos. 1,000,001 to 1,250 000.

Wednesday, February 11th.—Humphrey Pump Co., Ltd.—3,000 additional ordinary shares of £1 fully paid, Nos. 130,001 to 133,000.

And ordered the undermentioned to be quoted in the Official List:—

Marconi's Wireless Telegraph Co., Ltd.—Further issue of 250,000 ordinary shares of £1, as above.

Metropolitan Railway Co.—Further issue of £504,216 3½ per cent. "A" debenture stock.

Applications have been made to the Committee to allow the following to be quoted in the Official List:—

Adelaide Electric Supply Co., Ltd.—Further issue of £25,000 5 per cent. debenture stock.

Commercial Cable Co.—£4,446 additional sterling 500-year 4 per cent. debenture stock.

Reduction of Capital.—THE PREMIER ELECTRIC CONTROL, LTD., AND REDUCED.—A petition for the confirmation of the reduction of capital from £10,000 to £4,125 by reducing the nominal amounts of all the preference shares from £1 to 16s. 6d., and all the ordinary shares from £1 to 1s. 6d., has been presented and will be heard on February 3rd.

Liverpool Overhead Railway Co.—The directors have resolved to recommend the payment of dividends at the rate of 5 per cent. per annum on the preference shares, and 3½ per cent. per annum on the ordinary shares for the half-year ended December 31st, 1913, making with the interim dividend of 2½ per cent. per annum paid in August last, a dividend at the rate of 3 per cent. per annum on the ordinary shares for the year.

Prospectus.—*Melbourne Electric Supply Co., Ltd.*—The list is to close to-day, Friday, in an issue of £150,000 5 per cent. consolidated debenture stock at 97½ per cent. The progress of the company has been fully recorded in our pages recently; the money is required to enable the company to cope with the demand.

Montreal Light, Heat and Power Co.—The directors have declared a dividend of 2½ per cent. (at the rate of 10 per cent. per annum) for the quarter ending January 31st.

St. James' and Pall Mall Electric Light Co., Ltd.—The directors recommend a balance dividend on the 7 per cent. preference shares for the half-year to December 31st of 3s. 6d. per share, and 7s. per share on the ordinary shares, making, with the interim dividend paid thereon, a total distribution of 12 per cent. for the year. This compares with 10 per cent. for the previous year.

Bank Rate.—The Bank Rate was yesterday reduced from 4 to 3 per cent.

STOCKS AND SHARES.

Tuesday Evening.

THE altered condition of affairs in the Stock Exchange, to which reference was made here last week, is still further apparent in all the investment markets round the House. The Bank Rate reduction to 4 per cent. is considered merely a stepping-stone to a further decline, and 3 per cent. is predicted as the probable Bank minimum within the next week or so. Money has come to the Stock Exchange in streams. Investment securities have been rising in price hand over fist. The demand outstripped the supply, and in all quarters of these departments substantial advances have been secured. Gains of 3 to 13 points are scattered broadcast over our own price lists this week. For the Electrical markets have shared fully in the all-round strength. It is particularly noticeable how the buyers have run after Debenture and other high-class stocks. In the more speculative groups the recoveries in everything connected with Mexico might be termed sensational or dramatic, had those two adjectives not lost most of their weight in consequence of incessant employment by financial journalists during the past fortnight. The queer part of it is, so far as Mexico is concerned, that the news from that country itself is still extremely vague and nebulous. This did not appear to weigh with the buyers, and the people in the market, who had been obliged to take stock all through the bad times, hoped that they were getting "a bit of their own" back—to drop into colloquialism—by putting up the prices with ever-increasing confidence, as they found that the brokers who came to them were buyers almost to a man.

Labour has again troubled the Home Railway market. The strike in the coal trade and the lock-out in the building trade gave pause to the prospective buyer of Home Railway stocks, who feared lest there might be extension of the troubles. With the atmosphere thus inclined to be somewhat dull, the wiseacres who forecast dividends cautiously modified their estimates, which also had its effect upon prices. On the whole, however, the market maintained a fair amount of firmness, and fixed-interest stocks continue to go ahead gaily, while a good Scottish Railway dividend revived the hopes of the optimists.

While Metropolitan Consolidated is but ¼ up, the Surplus Lands stock rose 2, and the Debenture and Preferences are all a point higher. Districts went back ½, but regained the decline, and rises occurred here as well in the prior charge securities. Underground Electric shares (both £10 and 1s.) further improved, and the 6 per cent. first Debenture gained 2 points. London United Tramways Debenture stock, which stood below 60 two or three weeks ago, has now risen to 66. Central London Assented stocks are harder, and Yorkshire Preference rose to 4 upon the increase in the dividend. Lancashire United Debenture is 2 better.

All the changes in the Electrical Supply section are in favour of holders. Debenture stocks and Preference shares are in strong demand; there is not nearly enough to supply those who want it. Amongst the shares, rises occurred in St. James', Charing Cross, Chelsea, Counties, Westminsters and South Londons. The approach of the half-yearly dividend time serves to direct renewed attention to the market, which is in a hopeful and buoyant condition.

Following upon the rises in Mexican issues last week have come further big gains. Of these, the principal are 13 points in Mexican Light and Power Preference and 10 in the Bonds, 13 in Monterey Debenture, and nearly 10 in both classes of Mexico Tramway Bonds. Buyers have been avid in their appetite, and the whole of the Latin-Canadian group is sensibly better. British Columbia Electric issues further improved upon their previous rises, and the Deferred stock, which was 98 the other day, now stands at 119½, a recovery of 12 on the week. Brazilian Tractions spurted 6 points. Rio Tramway 5 per cent. Mortgage bonds put on 5½. Mexico Tramways Common touched 73, came back again to 70½, and then ran up to 74½, a rise of 5½ on balance.

The improvement spread to others of somewhat similar nature. Anglo-Argentine Tramways descriptions are strong, Bombay Electric Debentures have risen, Canadian General Electric gained 3, and Montreals 2½—the last-named upon the declaration of a quarterly dividend at the rate of 10 per cent. per annum. Shawinigan Water went up 4. Cape Electric Trams regained their small loss of last week, and most things South African have been booming. Para Electric Preference are better, Brazilian issues, like those of Mexico, coming into favour once more. This may be due in some measure to the rise in the price of raw rubber, which has caused a "boomlet" in plantation rubber shares, and revived hopes of their going better still.

There are many rises amongst Telegraph and Telephone stocks. The demand for stock has spread round this market, and jobbers frankly admit that they cannot supply all that is wanted in the way of prior charge securities. Nor does putting up prices appear to have much effect in tempting sellers, most of whom appear to be on the lookout for better prices yet before they realise. So far as appearance is concerned, Mackay Common shares, with a rise of 6, attracted most attention, but the market in this stock is mainly in New York, and, so far as this country is concerned, the improvements in British Telegraph securities are much more interesting. Reference to the price list is the best way to obtain a fitting idea of the strength of the upward movement.

Another strong spurt took Marconis up to 4 1/16 this (Tuesday) evening, dealings being continued late in the street market. The orders came partly from America, partly from Dublin, and partly from more local sources, and the Preference shares, of course, rose with the others. Attention is being paid to the shares of the Marconi Marine Company, which have risen a trifle to 1¾; as a speculative proposition, they are said to be worth considering. Trust Companies' shares have risen with the rest, Globes being conspicuously good.

The Manufacturing group has gone the way of the others. Callenders, Castner-Kellners, Henley's Preference, Aron Ordinary and Preference, British Aluminium and British Insulated all show rises. The Debenture stocks of Cromptons and Brush have improved, and the cry is for more stock. Some idea of the eager way in which it is snapped up when any comes to market may be gathered by the fact that the Melbourne Electric offered its shareholders at the beginning of the week £150,000 5 per cent. Debenture stock, and the whole was taken in an hour or two. The line of Edison & Swan Debenture, which we mentioned last week as being on offer at that time, had no difficulty in finding a home; and many of the quotations in the lists overleaf are really better than they appear, since it is easier to sell stock than it is to buy.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Jan. 27th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	..	⅞ — 1	..	Nil
Do. 5 % Pref.	1	5	5	⅞ — 1 xd	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	12 — 14	..	..
Do. Do. Deferred	100	..	..	5 — 6¼	+ ⅛	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	+1	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	8	..	52 — 55	..	5 9 1
Do. 5 % Perp. Deb.	100	5	5	92 — 96	..	5 5 5
Do. 4½ % 2nd Deb.	100	4½	4½	76 — 79	..	5 14 0
Central London Railway, Ord.	100	8	8	59 — 64	..	4 13 9
Do. Gtd. Assented	100	..	4	83 — 85	..	4 14 3
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	84 — 86	+1	4 18 0
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	81 — 83	+2	4 16 5
Do. 4 % Deb.	100	4	4	95 — 97 xd	..	4 2 6
City & S. London, 5 % Pref., 1891	100	5	5	96 — 98	..	5 2 0
Do. Do. 1896	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1908	100	5	5	93 — 95	..	5 5 0
Do. 4 % Deb.	100	4	4	88 — 90	..	4 9 0
Hastings Trams, 6 % Pref.	1	6	6†	⅜ — ½	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 5 8
Lancashire United, 5 % Deb.	100	5	5	80 — 82	+2	6 2 0
London and Suburban, Ord.	1	..	..	⅛ — ¼	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	¹⁵⁄₁₆ — 1	..	7 5 6
Do. Do. 4½ % 1st Deb.	100	4½	4½	72 — 77	..	5 17 0
London Elec. Railways, 4 % Deb.	100	4	4	89 — 91	..	4 7 11
London United Trams, 4 % Deb.	100	4	4	64 — 68	+2	5 17 8
Metropolitan Railway Consol.	100	1⅝	1½†	46 — 46½	+ ½	3 11 3
Do. Surplus Lands	100	2½	2½†	60 — 62	+2	4 8 9
Do. 3½ % Deb.	100	3½	3½	84 — 86	+1	4 1 4
Do. 3½ % Pref.	100	3½	3½	81 — 83	+1	4 4 4
Do. 3½ % Con. Pref.	100	3½	3½	78 — 80	+1	4 7 6
Metropolitan District Ord.	100	Nil	..	31½ — 32½	..	Nil
Do. 6 % Deb.	100	6	6	186 — 189	..	4 6 4
Do. 4 % Deb.	100	4	4	91 — 93	+1	4 6 0
Do. 4 % Prior Lien	100	4	4	94 — 96	..	4 3 4
Do. 4½ % First Pref.	100	4½	4½	82 — 84	+1	5 7 2
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 11 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	80 — 84	..	5 7 2
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	¾ — ⅞	+ 1/16	..
Do. 5 % Pref.	1	5	5	⅞ — 1	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅞ — 1	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	8⅜ — 8⅞	+ ⅛	Nil
Do. "A"	1/-	..	..	1/16 — 1/32	+ 1/32	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	115 —117	+2	5 2 7
Do. 4½ % Bonds	100	4½	4½	98 —100	..	4 10 0
Do. 6 % Income	100	6	6	93½ — 94½	..	6 7 0
Yorkshire (West Riding). Ord.	5	Nil	..	⅝ — ¾	..	Nil
Do. 6 % Pref.	5	3	4	3⅞ — 4⅛	+ ⅛	4 14 3
Do. 4½ % Deb.	100	4½	4½	79 — 84	..	5 7 2

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅛ — 5⅛	+ 1/16	5 8 5
Do. 2nd Pref.	5	5½	5½	4⅛ — 4⅜	+ ⅛	6 0 7
Do. 4 % Deb.	100	4	4	80½ — 91½	+ ½	4 7 5
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % Deb.	100	5	5	97 — 99	— ½	5 1 0
Auckland Trams, 5 % Deb.	100	5	5	102 —105	..	4 15 3
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	93½ — 95½	+1½	4 14 3
Do. 5 % 2nd Deb.	100	5	5	97 — 99	+2	5 1 0
Brazilian Traction, Light and Power	$100	6	6†	91 — 93	+6	6 9 0
Brisbane Trams Invt., Ord.	5	8	8	7⅝ — 8⅛	..	4 18 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
B. Columbia Elec. Rly., Def.	100	8	8†	117 —122	+12	6 11 2
Do. Pref. Ord.	100	6	6	107 —111	+4	5 0 1
Do. 5 % Pref.	100	5	5	108 —105	+3	4 15 3
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	94 — 98 xd	..	4 12 0
Do. 4½ % Con. Deb.	100	4½	4½	93 — 96	+2	4 8 7
Calcutta Trams, Ord.	5	7½	5†	6 — 6½	..	5 15 5
Do. 5 % Pref.	5	5	5	4⅛ — 5 5/16	..	4 16 7
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	⅝ — ¾	— 1/32	6 13 4
City Buenos Aires Trams (1904)	5	5†	5	5 1/16 — 5 1/16	+ 1/16	4 0 0
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	89 — 93	+1	5 2 6
Havana Elec. Rly., 5 % Bonds	$1000	5	5	93½ — 97½ xd	..	Nil
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	5 11 1
Do. 5 % A Deb.	100	5	5	85 — 90	..	Nil
Do. 6 % B Deb.	100	3	..	10 — 20	..	
La Plata Elec. Trams, Ord.	1	..	..	⅜ — ½	..	..
Do. Pref.	1	4½d.	6	¾ — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅛ — 1⅜	..	4 7 3
Do. 6 % Pref.	1	6	6	1 1/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4½ — 5½	..	5 14 3
Elec. Tr. (1904), Deb.	100	5	5	99 —101	..	4 19 0
Manaos Trams & Lt., 1st Deb.	100	5	5	79 — 82	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	..	5 1 6
Mexico Trams Com	$100	7	7	73 — 76	+5½	..
Do. Gen. Con. 5 % Bonds	..	5	5	83 — 88	+9½	5 13 8
Do. 6 % Bonds	100	6	6	84 — 87	+8½	6 10 6
Para Elec. Rlys. & Lt., Ord.	5	10	10†	5 — 5½	..	9 1 10
Do. 6 % Pref.	5	6	6	4⅜ — 4¾	+ ⅛	6 3 1
Do. 5 % 1st Deb.	100	5	5	93½ — 95½	..	5 4 6
Perth (W.A.) Elec. Tr., Ord.	1	5½	..	1¼ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	100 —102	+2½	4 18 0
Do. 5 % Mort. Bonds	100	5	5	94½ — 96½	+5½	5 3 6
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	98 —101	+2	4 19 0
Singapore Trams, 5 % Deb.	100	5	5	87 — 91	+1	5 10 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	98 —100	..	5 0 0
Un. Elec. Trams Monte Video	5	7	7	4½ — 4¾	— ⅛	7 7 4
Do. 6 % Pref.	5	6	6	4½ — 5½	+ ⅛	5 14 3
Do. 5 % 1st Deb.	100	5	5	94 — 97	+ ½	5 3 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	96 — 97	..	4 12 9

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord.	10	6	5†	9 — 10	..	6 0 0
Do. 4½ % Pref.	10	4½	4½	8⅝ — 9⅛	+ ⅛	4 18 8
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96	..	4 13 9
Brompton & Kensington, Ord.	5	10	9†	8⅝ — 9⅛	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8⅝	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	90 — 93	..	4 6 0
Charing Cross, West End & City	5	5	5†	4⅛ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	+ ⅛	4 17 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4⅛	+ ⅛	5 6 0
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 8 0
Chelsea, Ord.	5	5	4†	4⅞ — 5⅛	+ ⅛	4 15 8
Do. 4½ % Deb.	Stock	4½	4½	95 — 98	..	4 11 9
City of London, Ord.	10	9	6†	16⅛ — 17⅛	..	5 2 10
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	116 — 120	+1	4 3 4
Do. 4½ % Second Deb.	100	4½	4½	98 — 101	+ ⅛	4 9 1
County of London, Ord.	10	6	5†	11⅝ — 12⅛	+ ⅛	4 17 0
Do. 6 % Pref.	10	6	6	11⅝ — 12⅛	+ ⅛	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	101½—103½	+ ½	4 7 0
Do. 4½ % Second Deb.	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	..	..	⅝ — ¾	..	Nil
Do. 6 % Cum. Pref.	5	6	6	5⅞ — 6⅛	..	7 5 5
Do. 6 % Non-Cum. Pref.	5	..	..	1⅛ — 1⅜	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	81 — 84	+1	5 7 2
Folkestone	5	6	6	4⅜ — 4¾	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4¾	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	87 — 89 xd	..	5 1 2
Hove	5	8	8†	8⅜ — 9⅛	..	4 17 3
Kensington & Knightsbridge, Ord.	5	8	8†	7⅞ — 8⅛	..	4 19 8
Do 4 % Deb.	Stock	4	4	91 — 93	+1	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	74 — 78 xd	..	5 15 6
London Electric, Ord.	3	2½	..	1⅛ — 1⅜	..	4 12 1
Do. 6 % Pref.	5	6	6	4⅛ — 5⅛	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 3
Metropolitan	5	4	4†	3⅞ — 4⅛	..	5 3 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	96 — 99	..	4 10 10
Do. 3½ % Mort Deb.	Stock	3½	3½	81 — 84	+1	4 3 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 —103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅞ — 10½	..	5 14 3
Oxford	5	7	6†	6 — 6½	..	5 7 8
St. James' and Pall Mall, Ord.	5	10	10†	8⅝ — 9⅛	+ ⅛	5 9 7
Do. 7 % Pref	5	7	7	6⅝ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	82 — 85	..	4 2 4
South London, Ord.	4	5½	..	3 — 3⅜	+ ⅛	6 10 2
Do. 5 % First Mort. Deb.	100	5	5	98 —101	+1	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1 3/16 — 1 5/16	..	5 14 9
Do. 4½ % First Deb. Stock	100	4½	4½	93 — 96	..	4 13 9
Urban, Ord.	£3	Nil	..	⅝ — ¾	..	..
Do. 5 % Cum Pref.	5	3†	..	2⅜ — 3	..	5 0 0
Do. 4½ % First Mort. Deb.	100	4½	4½	85 — 88	+1	5 2 3
Westminster, Ord.	5	10	10†	8⅝ — 9⅛	+ ⅛	5 9 7
Do. 4½ % Cum Pref.	5	4½	4½	5 — 5⅛ xd	..	4 5 10

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 8s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 27th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	£	6	6†	5⅛ — 5⅝	..	£ s. d. 5 11 7
Calcutta, Ord.	£	8½	5†	7⅝ — 7⅞	..	5 8 0
Do. 5 % Pref.	£	5	5	4¹³⁄₁₆ — 5	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	89½ — 91½	+1	5 8 3
Canadian Gen. El. Com.	$100	7	8	107 —112	+3	7 2 10
Do. 7 % Pref.	$100	7	7	119 —124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	5	..	⅞ — ⅝	..	7 12 0
Do. 5 % Deb.	100	5	5	90 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	87½ — 89½	— ½	6 14 1
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	94½ — 96½	+1	5 3 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅛ — ⅜	..	Nil
Do. 6 % Pref.	£	6	6†	¹⁵⁄₁₆ — 1	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	103 —104	+1½	4 16 2
Madras, Ord.	£	Nil	..	1½ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 —104	..	4 16 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	68 — 72	+4	6 19 0
Mexican Lt. & Power, Common	$100	4	4†	47 — 50	+6	..
Do. 7 % Cum. Pref.	$100	7	7	85 — 89	+18	7 17 4
Do. 5 % 1st Mort. Gold Bds.	..	5	5	83 — 87	+10	5 15 0
Do. 5 % 2nd Mort. Bonds	100	5	5	65 — 68	+7½	7 7 1
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	* 100	1912. 5	1913. 5	64 — 69	+13	£ s. d. 7 5 0
Montreal, Lt., H. and Power	$100	9	10†	223 —227	+2½	4 9 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	101 —106	..	5 13 2
Do. 5 % Deb. Stock	Do.	5	5	99 —101	+1	5 0 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 4
Shawinigan Water, Capital	$100	5½	6†	140 —145	+4	4 5 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	104½—106½	+1	4 14 9
Do. 4½ % Per. Deb.	Stock	4½	4½	96 — 98	..	4 11 10
Toronto Power, 4½ % Deb.	Do.	4½	4½	95 — 98	..	4 11 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	87 — 89	..	5 12 4
Victoria Falls Power, Pref.	1	6	6	²⁵⁄₃₂ — ²⁷⁄₃₂ xd	..	7 2 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 3

MANUFACTURING COMPANIES.

Aron, Ord.	£	7	..	¹¹⁄₁₆ — ¹³⁄₁₆	+¹⁄₁₆	8 12 4
Do. 6 % Pref.	£	6	6	¹³⁄₁₆ — ⅞	+¹⁄₁₆	7 7 8
Babcock & Wilcox	£	16	14†	2²⁹⁄₃₂ — 3	—³⁄₃₂	5 5 6
Do. Pref.	£	6	6	1⅝ — 1¾	..	4 3 6
British Aluminium, Ord.	£	..	..	1¹³⁄₁₆ — 1¹⁵⁄₁₆	+³⁄₃₂	..
Do. 6 % Cum. Pref.	£	6	6	⅞ — ¹⅞	..	6 12 6
Do. 5 % Prior Liens Debs.	100	5	5	94 — 97	+1	5 3 0
Do. Deb. Stk.	100	5	5	86 — 89	..	5 12 4
B.I. & Helsby Cables	£	10	8†	8⅞ — 9½	..	5 8 1
Do. Pref.	£	6	6	5⅞ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	99 —102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	£	Nil	..	1½ — 1⅝	..	Nil
Do. Deb.	100	4	4	67 — 70	..	5 14 4
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 6
Browett, Lindley, Ord.	£	..	..	9/- —9/-	..	Nil
Do. Pref.	£	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	£	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	78 — 83	+3	6 0 6
Do. 4½ % Deb.	100	4½	4½	39 — 43	..	10 9 4
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	£	15	5†	11 — 11⅝	+ ⅛	6 7 6
Do. Pref.	£	5	5	4⅞ — 5⅛	+⅛	4 17 9
Do. Deb.	100	4½	4½	97 —100	+1	4 10 0
Castner-Kellner	£	20	22½	2⅜ — 2½	+¹⁄₃₂	..
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Crompton & Co., Deb.	100	5	5	74 — 78	+3	6 8 2
Dick, Kerr	£	1	Nil	⅛ — ¼	..	..
Do. Pref.	£	1	6	³⁄₁₆ — ¼	..	7 2 2
Edison & Swan, A, £2 paid	£	5	Nil	0 — ⅛	..	Nil
Do. fully paid	£	5	Nil	1 — 1½	..	Nil
Do. 4 % Deb.	100	4	4	54 — 58	..	6 17 11
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	£	1	5	⅜ — ⅝	..	7 5 6
Do. Pref.	£	1	7	⅛ — 1⅛	..	6 11 9
Greenwood & Batley, Pref.	£	10	7	6¾ — 7½	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	£	10	6	9⅜ — 10½	..	5 18 5
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	£	15	10†	13½ — 14	..	5 7 1
Do. Pref.	£	5	4½	4⅜ — 5	+ ⅛	4 10 0
Do. Deb.	100	4½	4½	100 —102	..	4 8 3
India-Rubber, G. & T.	£	10	7½	11 — 12	..	6 5 0
Do. Pref.	£	10	5	9 — 9⅝	..	5 2 7
Telegraph Construction	£	12	20	5†	37 — 39	..
Do. Deb.	100	4	4	96 — 98	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	65 — 69	..	5 16 0
Do. B 4 % Cum. Pref.	100	..	..	51 — 56	..	..

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	£	10	4½	4½	6¼ — 6⅝	..
Do. 5 % Deb. Red.	£	Stock	5	5	98 — 96	..
American Telep. & Teleg., Cap.	$100	8	8	127 —130	+2	6 3 0
Do. Collat. Trust	$1000	4	4	90 — 93	+2	4 6 0
Anglo-American Telegraph	£	Stock	3	3	62 — 65 xd	..
Do. 6 % Pref.	£	Do.	6	6	105½—106½xd	+1⅝
Do. Def.	£	Do.	30/-	..	23½ — 24	+ ⅜
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	103 —105	+1	4 15 2
Chili Telephone	£	5	8	..	7⅞ — 7¹⁵⁄₁₆	..
Commercial Cable, Stlg. 4 % Deb.	$100	Stock	4	4	79 — 81	+ ½
Cuba Telegraph	£	10	6	6†	8½ — 9¼	+ ¼
Do. 10 % Pref.	£	10	10	10	15½ — 16	+ ½
Direct Spanish Telegraph, Ord.	£	5	4	4	8¼ — 8⅝	..
Do. 10 % Cum. Pref.	£	5	10	..	6¾ — 7¼	..
Direct United States Cable	£	10	4	4†	6½ — 7	+ ¼
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	97 — 99	+1	4 10 10
Eastern Telegraph, Ord. Stock	£	Stock	7	7	128 —131	+3
Do. 3½ % Pref. Stock	£	Do.	3½	3½	76 — 78	+1½
Do. 4 % Mort. Deb.	£	Do.	4	4	95 — 97	+1
Eastern Extension	£	10	7	7	12¼ — 12⅜	+ ¼
Do. 4 % Deb.	£	Stock	4	4	94 — 96	..
Globe Telegraph and Trust	£	10	6	6†	11¼ — 11⅜	+ ¼
Do. 6 % Pref.	£	10	6	6	12½ — 12⅝	+ ¼
Great Northern Telegraph	£	10	20	5†	31½ — 33½	+ ½
Indo-European Telegraph	£	25	13	5†	57 — 59	+ ½
Mackay Companies Common	$100	5	5	83 — 87	- 6	5 15 0
Do. 4 % Cum. Pref.	$100	4	4	67 — 71	+1	5 12 8
Marconi's Wireless Telegraph	£	1	20	20	3⅞ — 4	+ ⅜
Do. 7 % Cum. Partic. Pref.	£	1	17	..	³⁄₁₆ — ⅛	+¹⁄₁₆
Monte Video Telephone, Ord.	£	1	6	6	⅛ — ¼	..
Do. 5 % Pref.	£	1	5	5	⅛ — ¼	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	100 —101	+1	4 9 0
Oriental Telep. and Elec.	£	1	10	10†	1⅝ — 2	..
Do. 6 % Cum. Pref.	£	1	6	6	1¹³⁄₁₆ — 1¹⁵⁄₁₆	..
Do. 4 % Red. Deb.	£	Stock	4	4	86½ — 88½	..
Pacific and European Tel., 4 % Guar. Debs.	£	Do.	4	4	98 — 100	+2
Reuter's	£	10	10	10†	9 — 10	+ ½
Submarine Cables Trust	£	Cert.	6	6	122½ —125½	..
Telephone Co. of Egypt, 4½ % Deb. Red.	£	Stock	4½	4½	96 — 98	+ ½
United River Plate Telephone	£	5	8	6†	6⅝ — 7	+ ⅛
Do. 5 % Cum. Pref.	£	5	5	5	5 — 5½	+ ⅛
West Coast of America	£	2½	2½	..	1⅝ — 1¾	..
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	£	10	1½	1½	2⅜ — 2⅝	+³⁄₁₆
Do. 6 % Cum. 1st Pref.	£	10	6	6	9⅜ — 10½	..
Do. 6 % Cum. 2nd Pref.	£	10	6	6	9 — 9½	..
Do. 5 % Debs.	100	5	5	97 — 99	+1	5 1 0
Western Telegraph, Ltd.	£	10	7†	7	12⅜ — 13½	+ ⅛
Do. 4 % Debs.	£	Stock	4	4	92½ — 94½	+1½
Western Union 4½ % Fdg. Bonds	$10.0	4½	4½	95 — 98	+3	2 11 10

* Unless otherwise stated all shares are fully paid. † Interim dividend. a Paid in deferred interest warrants.

Bank rate of Discount 4 per cent., January 22nd, 1914.

Walking Races.—The Hackney Walking Club, which was formed as a result of the successful electrical trades London to Brighton walking race, 1911, has decided to hold in the near future the following events, for each of which there is no entrance fee:—February 28th, 20 miles scratch race and yacht handicap over a measured course; Easter, 100 miles time trial walking race finishing at Southend-on-Sea; Whit-Monday, third annual London to Southend walk. Full particulars can be obtained from the Hon. Secretary, Mr. S. C. Haynes, 20, Penda Road, Clapton Park, London, N.E. For the 100 miles walk already seven entries have been received, these being A. R. Edwards (late of May-Oatway Fire Appliances, Ltd.), H. Gregory (Crypto Electrical Co.), E. G. Hedges (Thames Ditton), C. H. Mallvoire (Crypto Electrical Co.), winner of the 18 miles race, H. V. Wallington (Harringay), and J. H. Williamson, of Manchester. It is understood that S. C. Haynes (Associated Fire Alarms, Ltd.), winner of the London to Southend walk, 1913, will not be a competitor in the 100 miles event.

TE NICAL ASPECTS OF THE RAILWAY CONTROL SYSTEM.

[BY AN ENGINEERING CORRESPONDENT.]

PUBLIC attention has been directed to the subject of railway control by Lt.-Colonel Druitt, of the Board of Trade, whose report concerning a runaway train and subsequent collision in the north of England concludes as follows:—

"This accident illustrates the advantage of a system of control in case of accident where the line is suddenly obstructed at any point, as the trains can be quickly diverted or broken up instead of having to stand idly behind one another until the line is cleared."

Practically every railway company in this country has adopted, or is contemplating, a special system of control. It would be well therefore to consider in what respects the new method of working differs from that which prevailed a few years ago, and also the technical difficulties involved.

The dictionary meaning of the word "control" is given as "restraint," "authority," "command"; but from a railway standpoint, a modern "control" system should be defined as a scientific means of regulating traffic.

Its object and scope are to ensure that empty trucks are drafted about the line in sufficient numbers to enable goods agents to cope efficiently with local traffic; to see that the more important trains from goods yards, exchange depôts and colliery sidings have preference over the less important ones, and in a special way to direct the movements of all goods and mineral traffic. The control system is also made use of for providing engines and special power, arranging for the relief of goods guards and other functions of a routine character.

Railway Traffic Regulators.—In order to prevent overlapping and to reduce inefficiency to its lowest denominator, a new department, called the "central control," has been brought into existence. Its chief officer and his colleagues are men thoroughly versed in the manipulation of railway traffic. Their knowledge, which is born of a widespread experience, would enable them to judge of the relative importance of two goods trains converging upon a junction, and to decide quickly which should have precedence of the road. That the junction in question may be many miles away from headquarters is a detail of minor importance for, as will be explained later on, both the trains and junction in question would be portrayed in miniature near the "Regulator's" desk. Full power is given the controller to alter the ordinary working arrangements of the trains as occasion demands. Wagons cannot be added or deducted from any train load without authority from the chief controller, nor is an engine driver allowed to perform special shunting operations without permission from the same source.

The control staff or "regulators," as they are sometimes called, should know the haulage capacity of engines, should be able to calculate the speed of trains of different kinds, and must bear in mind the accommodation available at the various loops and refuge sidings dotted about the line.

A control office is unique in respect of its equipment. The walls are decorated with a gigantic diagram, beautifully coloured and highly finished, representing all the sections of line under control administration. It may be mentioned at this stage that a large railway company would probably have four or more control depôts, connected telephonically with, but subordinate to, a chief control office. On the diagram before mentioned are clearly portrayed the whole of the main tracks, sidings, loops and signal boxes within the control area. Small flags of different shape and colour are used to indicate the goods trains of various types. These flags are placed in metal sockets on the diagram so that the precise whereabouts of traffic is visually depicted before the controller's notice. As the trains speed on their way the flags are moved by hand to fresh positions corresponding with those of the actual train movements. This procedure is repeated until the terminal stations are reached or until the trains have passed a prescribed limit.

There are also two other notable features about a control room: It is strictly private and extremely quiet. Attention to the matter of privacy enables the staff to get along with their work unhampered by inquisitive sightseers. The need for quietness, however, involves a question of technical appliances, and at the same time it rules out of consideration any electrical device that is noisy.

The Apparatus that makes a Control system practicable is the telephone.—Like the arms of a gigantic octopus, copper wires extend to the uttermost parts of the railway. An immense number of telephones are bridged across these metallic lines, and brief advices are passing to and fro both day and night. Each operator in the control room sits at a desk furnished with a row of eye-ball indicators, electric lamps or other switchboard apparatus. He is also provided with the usual head and chest gear, which should be of the best quality so that shouting is unnecessary. Fortunately, the manufacturers in this country are able to supply an excellent article and no difficulty need be experienced in choosing a first-class equipment.

The same remarks are true at the outstations, though in rather a different sense. Loud sounding bells and a lusty voice are really needed where engines are blowing off steam and where the marshalling of goods wagons make telephonic sounds a difficult matter. It will be obvious that a combination transmitter and receiver—similar to that used in a control room—would be unsuitable at wayside places. Hence an ordinary telephone, differing only in a few structural details, is found to meet the case.

Several telephone systems are on the market at present. Some are wholly selective in their operation, whilst others are partly selective. Ringing out to line is accomplished either by means of small rotary converters, magneto generators, direct current press buttons, or combination ringing and listening keys. As the advocates of each system claim that their apparatus is specially adapted to control requirements, it would be unfair to boom one particular system to the disadvantage of the remainder.

An opinion may be ventured regarding the voltage of a control telephone circuit. Preference should be given to a low pressure system rather than to a high one, but as "low" and "high" are relative terms, the mistake must not be made of regarding these words as having a Board of Trade signification. For instance, there are telephone control systems working at a pressure of 160 volts, and others at 24 volts, relays being employed in connection with the latter to transmit the low tension current as required. Doubtless both voltages have much to recommend them, but if a telephone wireman had to work among the wires on a wet day he might receive an objectionable shock from a wire at the higher voltage.

Aerial Construction.—What has been already said may perhaps indicate the working conditions on our English railways, whereas the concluding remarks will show the need for exactitude of detail in the work of aerial construction. Failure to build a good telephone line will not merely reveal the work of a novice instead of that of an engineer, it will bring discredit upon the best control system in the world. To those inexperienced in the erection of line wires on railway slopes, the task may appear comparatively easy and so straightforward that mistakes would be exceptional. In the first place it

should be remembered that telephone control lines have to be run on telegraph routes, across junctions, round curves, over signal boxes, and along underground paths. The officer in charge has to zealously guard against three things so that when completed the wires may be free from (*a*) metallic faults, (*b*) induction, (*c*) over-hearing.

Development of metallic faults.—To minimise the chance of contact or earth from other wires, a position on the pole should be decided upon where such interference is least likely to occur. That position is at the top. The upper arms should be therefore reserved for control wires, and though such a decision may involve the moving of existing wires to a lower position on the pole, the alteration should be made.

As regards the choice of metal, little need be said: either copper or bronze would be used. The balance is in favour of copper.

It is rather on the erection of control telephone wires that a few pertinent remarks may be offered. Experience has shown that it is one thing to issue instructions and another thing to have them obeyed. Tension vices in suitable numbers may be dealt out to gang foremen: a thermometer may be provided together with a table of sags and stresses to ensure adherence to a specified factor of safety, but unless a strict watch is kept, copper wires are regulated by what is commonly known as "a rule of thumb." And guess work nearly always leads to disastrous results on the occasion of a severe frost. Workmen accustomed to the manipulation of iron wires are apt to display contempt for an instruction which forbids them dragging a copper wire along the ballast or across a rusty stay, but with a courteous firmness on the part of those in authority, the correct method of erection is soon realized and the rules are faithfully observed. If care is exercised in the erection of copper wires, it is amazing what a length of time they last and how few faults develop. Even amidst murky surroundings it is not an uncommon experience for a copper wire to remain in service for a period of 20 years.

Induction.—Only those who have had experience with series and parallel earth circuits can fully realize what an intolerable nuisance induction means. This is true in a marked degree of signalmen's telephone circuits, especially when the latter are adjacent to Wheatstone working postal wires. The special induction referred to manifests itself in the following manner: Commencing with a low humming noise the sound rises to a huge crescendo, making telephonic conversation almost inaudible. After a time the inductive sounds change to a curious staccato movement, then cease abruptly. Ordinary induction may be distinguished from the former in that it belongs to the buzzing or crackling variety.

As far back as 1878 the late Sir Wm. Preece had discovered that the best means of overcoming induction on telephone circuits lay in the use of metallic loops. Then came the order to "cross" wires at every eighth pole. This, however, did not give entire satisfaction. Postal engineers proved later on that elimination of inductive disturbance on metallic loops could only be accomplished by revolving the telephone wires, by equality of insulation, by careful regulation of the wires and of adjacent telegraph circuits.

The object of revolving "control" wires is to ensure that they are brought to the same average distance from all external disturbing influences; that the four spans of one telephone leg, forming a complete twist, are exactly counteracted by the same disturbing influence upon the other leg.

On a railroad, industrial sidings intersect the main line with surprising frequency. The laying of these sidings generally leads to a re-arrangement of the aerial telegraphs and the provision of one or more additional poles. By so doing the symmetry of the twist is destroyed and induction in one form or another is at once apparent.

"When one support is added (thus forming two spans out of one) the shorter of the two should be run straight so that the minimum length may be exposed to external inductive interference.

"When two supports are inserted, forming two additional spans, the wires should be twisted in the usual manner.

"When, however, three extra supports are necessary it would generally be advantageous to make four, by which means the twist will not be interfered with."—(Tech. Inst. xiii, pp. 58.)

Overhearing.—It has been truly said that symmetry of construction forms a very important element in securing immunity from inductive disturbance. It would be worth while differentiating between certain telephonic sounds of a well known character and the transference of articulate speech. The former may be due to actual faults such as earths or high resistance, and the precaution should first be taken of testing the defective route with a view to clearing such faults. On the other hand overhearing, or cross talk (as it is often called), on revolved telephone circuits is caused through lack of equidistance. It is important therefore that all wires on a pole should be bound in on the same side of the insulator. This may seem a trite statement to make, but only those whose daily occupation brings them in touch with aerial telephone lines will fully realize the value of such instruction.

The introduction of 48-inch arms made it possible for two telephone circuits to be erected at the four corners of a perfect square. On many railway systems and throughout the post office, arms are spaced 12 inches apart. This distance was selected, we are told, not because there was any particular virtue in that dimension, but because it had been determined by experience that 12 inches formed a safe and workable separating distance between the insulators upon the arms and between the arms upon the poles. From the standpoint of electrical effects any other square would have been equally suitable, and many illustrations of that statement of fact are evident to-day.

It will thus be seen that the methods by which inductive disturbance is overcome in ordinary telephone practice are much the same in solving the difficult problem of over-hearing on control circuits.

REVIEWS.

Recent Physical Research. By DAVID OWEN, B.A., B.Sc. London: *Electrician* Printing and Publishing Co., Ltd. Price 3s. 6d. net.

"Recent Physical Research" is based on a series of bi-monthly articles which appeared in the *Electrician* in 1910 and onwards, and the idea of the book appears to be to provide that long-suffering section of the community known as the "present-day student of Physics" with an opportunity of getting a knowledge of those branches of Physics which are at present a sealed book to him (presumably because his text-book is "several years behind the wave-front of advancing knowledge"). It is, of course, conceivable that there still exists the youth who, with an air of supreme confidence, remarked that he had "done *all* physics in three months—and I read from Ganot, and, of course, Ganot is the *last word!*" To such a one Mr. Owen's book will *not* appeal. But apart from such, the "present-day students of Physics" are a multitude which no man can number, and we have some difficulty in discovering the exact section for which Mr. Owen has written his book.

To the humbler students of physics, and especially to those who are engineers, and who are studying physics from a practical standpoint, positive rays and pressure of radiation and free electrons in metals can be of little interest. To the advanced students or professional physicists these subjects are commonplaces, and, by college lectures and

innumerable "monographs," will have become almost as familiar as the historic wave theory of light or the electric thermometer. There is, in fact, very little in this book that has not previously found its way into some book which is easily accessible to the advanced physics student. For example, practically the whole of the two chapters devoted to Pressure of Radiation have already been dealt with in Prof. Poynting's memoir "On the Pressure of Radiation," published over four years ago, and now in a host of public reference libraries.

"The Interaction of Ether and Matter," which is the subject of another paragraph, has been dealt with in great detail by Sir Oliver Lodge in his book on "The Ether of Space," published over two years ago. An even more flagrant case of "recent" research occurs in the chapter on Short Electric Waves and Long Heat Waves—the work of Langley and Rubens, Drude's Equation, and the Ketteler Helmholtz Dispersion formula, are all referred to, and a diagram of the Reststrahlen experiments is actually given in editions of Mr. Edser's book on "Light," published nearly 10 years ago.

Mr. Owen has certainly written and arranged his matter admirably, and has produced a dozen very readable articles, but the point is that this has all been done before, and that every student who *wants* this information has either already got it in his lecture notes or knows where to get it in the reference library. To the student who has lost his lecture notes or forgotten where to find what he wants in the reference library, we would heartily recommend this little book.—P.H.S.K.

Handbook of Technical Instruction for Wireless Telegraphists. By J. C. HAWKHEAD. London: The Marconi Press Agency, Ltd. Price 3s. 6d.

This is essentially an exposition of the Marconi system of wireless telegraphy as applied to ship and shore communication. No collected account of the appliances special to the Marconi system has hitherto been published in book form. The appearance of the work under review will, therefore, be welcomed, if for this reason alone, by others besides those wireless operators for whom it is primarily intended as a handbook. It treats the matter in an eminently practical way, and there can be no doubt that the volume will henceforth be a familiar object in the wireless cabin of every ship equipped with the Marconi system. The avowed intention is that it shall serve as a book of technical instruction to learners training to acquire the standard of efficiency demanded by Administrations, in accord with international regulations.

The book is divided into three parts, dealing with elementary technical electricity and magnetism, the theory of wireless telegraphy, and practical working information respectively. Of these it may be said generally that the first part is fairly adequate to the purpose in view, even quite good in some respects; the second part suffers from being over-condensed and stereotyped, while the third part forms by far the most useful and the best part of the work.

The illustrations throughout are numerous and generally very good. The exceptions are those in which the author tries to depict the electric and magnetic lines of force, as in figs. 33 and 70. In the latter case especially, the attempt is open to considerable criticism and can only be characterised as feeble. The text, in certain cases, is inclined to be loose in expression, as in the use of the term "resistance" where dielectric strength is intended, and in the statement that the permeability of iron decreases as the magnetic force increases. Perhaps the most serious criticism to be offered is in connection with the opening sentences of Chapter II, Part 2, where the author has "side-slipped" badly in explaining and sketching Lodge's experiment with syntonised Leyden jars. Both the explanation and the sketch are erroneous. A similar criticism applies to the explanation and diagram of currents induced by a moving magnet, as given in Chapter VI, Part 1. The illustration shows a balanced condition in which no deflection of the galvanometer would be produced.

In Part 3 special mention may be made of the very useful and instructive diagrams given, and of the description and methods of application of the testing buzzer. Although some of the information given is distinctly open to controversy, it is, on the whole, sound and reliable. Attention is drawn to an omission on page 284 in regard to a method of tuning the aerial with the aid of a wave-meter while using a very weak coupling of the transmitter, where the author fails to point out that unless the arrester gap is bridged the method is likely to fail.

The book is certainly very good value for the moderate price charged, and will, no doubt, be much improved in future editions.

Elementary Theory of Alternate Current Working. By CAPT. G. L. HALL, R.E. London: *Electrician* Printing and Publishing Co., Ltd. Price 3s. 6d. net.

Captain Hall has written a very common-sense book on Alternating Currents. As he says, the standard works on this subject can be read with more profit when a working knowledge of the elementary theory has already been acquired, and he has undoubtedly succeeded both in presenting these elementary principles in as simple a form as possible, and in his endeavour to "rob electrical phenomena of the mystery with which they are so often associated in the mind of the beginner."

A feature of the book is its division into short chapters of from 10 to 20 pages, each dealing with a distinct branch of the subject. There is an introductory chapter on the fundamental properties of alternating currents, followed by chapters on Inductance, Capacity, Resonance, and Power Measurement. The chapter on Resonance is especially interesting, and gives in very concise form the essential facts relating to the combined effects of inductance and capacity in giving rise to resonance in A.C. circuits—a subject that is generally omitted from elementary text-books, but which is of supreme importance in the design of A.C. machinery.

Single and three-phase generators are then described, and the book concludes with three chapters on the Synchronous, Induction and Commutator Motors. The book is well printed and illustrated, and bound in a serviceable cover.—P.H.S.K.

Natural Sources of Energy. By PROF. A. H. GIBSON. London: Cambridge University Press. 1913. Price 1s. net.

The text actuating this little book is the inevitable exhaustion of the so-called fossil fuels. Let this come sooner, or let it come later, it will arrive. At the moment the man in the street regards the end of coal as occurring when his own particular head has ceased to ache. And this vernacular phrase covers the standing opinion of most men.

When Brindley was making his famous mine tunnel at Worsley, and expressing to his Ducal client his hopelessness at the problem, the Duke inquired whether they were getting out a cartload of the rock daily. No, said Brindley. A barrow load? Again, No! The Duke passed his snuffbox and then put the question a third time, but based it on the capacity of the snuffbox, and was assured that much more than that humble measure was coming forth, to which the Duke replied: Then go on, Brindley, you will get through in time. And so with our coal, America's coal, and even the huge deposits of China, waiting until 400 million industrious Chinese enter the crazy race for terrestrial exploitation.

As regards petroleum, the author estimates the present output as only equivalent to 7 per cent. of the coal output, or to 15 per cent. if used in internal-combustion engines. He notes the ease with which oil deposits are exhausted, and does not appear hopeful of much being got from oil. Peat does not afford much hope for the long future. Radium, too, has to be dismissed with scant courtesy, and we are soon brought down to wind and water. The thermodynamic equation is explained, and then we return to fossil fuels and an estimate of how they are used, facts about gas producers, and so on, all of which seems to be begging the original question somewhat, and to pertain to some elementary book on steam power.

At Chapter IV we begin to move outside the beaten track into the realm of solar heat, but the solar motor does

not seem likely to help us much. Like the windmill, it appears to demand a large capital expenditure for a small power return, and, like the windmill, it is not of regular habits.

Steam to the weight of 4,800 lb. in eight hours does not seem much to get off an area of 10,000 sq. ft. A plant in sunny Egypt gave 1 H.P. from 100 sq. ft. of heating surface. Our author is rather strong on solar motors, for he says that the 5-mile coastal strip of Australia is good for 120,000,000 H.P., if only 1 per cent. of the strip were utilised. Advance, Australia!

Then there is tidal power. Of this we can only say that it will usually call for very costly head works. If any of our readers have been to l'Isle Bréhât, they may have seen the little tidal mill there with its big impounding dam, and its two pairs of stones, or was it four? The old miller offered it to the writer for a few thousand francs, and chucked in his house, pigs, and hens, only appearing to reserve his own family. But it is not everywhere that coastal formations go o the production of a 15-metre tide, nor is it everywhere that there is so convenient a bay to be dammed by a short dam, as there is at Bréhât. There is a similar mill a few miles away on the mainland, on the Lezardrieux River.

Our author sees the difficulties of tide power—the need of great accumulators, and the need for letting out all the stored water before it is blocked by the next tide.

But we do not see that any number of tidal mills will, even in theory, increase the braking effect of the tides on the earth's rotation. The mill will do work, and it will all end in heat, just the same as it does now. The author evidently has not seen Bréhât, but refers to the bay of Fundy, with its 40-ft. tide. We have always heard this stated as 70 ft., while the Chepstow tide is said to be from 45 to 60 ft. Vegetation remains, for we can always grow potatoes and make alcohol.

This is an excellent little book, very interesting to read, but, with our present limited knowledge, we see little chance for any power except that derived from the sun by way of rain and the earth's differences of level.

The Orinoco has a cresciente of 80 ft. at Ciudad Bolivar, and might be dammed up to that level, and again dammed lower down stream. It flows 7 or 8 miles an hour on a width of a mile or so at the narrows or Angostura, and is over 480 ft. deep, and this great river is said not even to rank with the earth's 12 biggest rivers, though probably for power purposes it does. It is to water power that our posterity will look. Meantime, let us kill the mosquito, the tsetse and other flies, and the tropics, where such rivers flow, will become healthy enough to live in, for it is only because of the flies that the tropical parts of the earth are not the best to live in. Meantime, some of us could stay here and batten on the transmitted energy. Power will be made ultimately by a few engineers abroad, food will be grown out there also, and manufacturing will be done in climates more suitable for work, by the aid of the very long-distance transmission which it remains for electrical engineers to find the way to carry out.

BRITISH PRACTICE IN THE CONSTRUCTION OF HIGH-TENSION OVERHEAD TRANSMISSION LINES.

BY B. WELBOURN, M.I.E.E.

Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, *January*, 1914.)

(*Concluded from page* 130.)

The pin type of insulator is most in favour in this country, and is likely to continue so while pressures remain at 20,000 volts; indeed, it is quite reliable up to 66,000 volts. The suspension type of insulator is necessary for really high pressures such as 100,000 volts. All main lines should be designed so that they may ultimately be worked at a higher pressure than that at which they are first operated. The time is approaching when there must be a further raising of working pressures on main alternating-current high-tension circuits, similar to the big change which was made in passing from 11,000 to 20,000 volts on underground cables eight years ago. The only commercially possible alternative would appear to be the Thury high-tension continuous-current system.

There is no difficulty in obtaining excellent pin-type insulators, but unfortunately many of those in use have not been of British manufacture. One British firm of porcelain makers has taken up this question vigorously in the last few years. Late deliveries of insulators by foreign makers are very frequent, and several months sometimes elapse before an order for a few gross of 20,000-volt insulators is completed.

Whether insulators are made in two parts, or not, it is of the utmost importance to insist on the parts being put together in such a way that no air cavity can exist.

Most engineers prefer brown, green, or neutral-tinted insulators as being less conspicuous than white and therefore less likely to attract the attention of stone-throwers, &c. On lines comprising two or more circuits it is sometimes advantageous to use insulators of different colour for each circuit in order to prevent mistakes and danger to linesmen. All insulators should be made of the highest grade porcelain which has been vitrified throughout and is absolutely non-absorbent of moisture and free from flaws, cracks or foreign matter. The colouring of insulators is given by the glaze, which must cover the entire surface, except the area where joints are made, and must be free from crazing, bubbles, cracks, &c. On completion, insulators should be tested both electrically and mechanically.

Suspension-type insulators can be very usefully employed at terminal poles (see fig 2). Such an arrangement materially reduces the cost of a terminal pole on a heavy line. The practice of using shackle insulators on high-tension lines at terminal and corner poles is to be condemned, because of the weakness of the insulator from the electrical point of view. All telephone-circuit insulators should be of the double-petticoat type when used under power wires.

It is important that all pins should be galvanised, and should be stiff enough to withstand every normal strain. They may be fastened to the insulator by a cement which will not swell on prolonged exposure to damp air, or by packing the free space with hemp or twine soaked in linseed oil, in such a way as to ensure that the insulator cannot work loose.

On all the best work a continuous earth wire, varying in size according to the conditions, is run from end to end of the line either above or below the power wires, and all metalwork on the poles, including a lightning spike, is substantially connected to it. The earth wire itself should be connected to an earth plate at every fifth pole by means of a conductor (of ample section for carrying the possible leakage current), which is protected from mechanical damage above ground by a creosoted wood strip or other means, and below ground from corrosion by being buried in pitch or being painted with a high-class paint, such as P. & B.

The connection to the earth plate must be well made to secure permanent results. One way which the author prefers is to have two bosses cast on the earth plate with 8-in. centres, and to drift into these the terminals of a standard copper tramway bond, to which is bound and soldered the conductor from above. These connections should be liberally painted as before. The earth plate itself should be 18 in. square, and of cast-iron not less than ½ in thick, and should be buried in small coke. Experiments have shown that this is the most efficient size of plate to use. The author wishes to lay special stress on the necessity of great care being taken with the installation of the earthing system and its subsequent maintenance, as human life may be dependent on it for safety. When placed above the power lines, the earth-wire should undoubtedly be of the same metal as the power lines, and not of galvanised steel, which has a shorter life than copper or aluminium, and will, on breaking, foul the power wires and interrupt the supply. No necessity exists in this country for earth-wire protection above the power lines.

Air-core choking coils consisting of not less than 12 turns of line wire are installed in series with each line wire to hold back the high-frequency oscillations until a horn-type air-gap arrester, placed on the line side of the coil, can spark over. In series with the arrester a non-inductive resistance is employed to limit the flow of current to earth to, say, 10 amperes, and for this purpose a carbon-rod resistance may be employed.

The author does not place any faith in horn arresters erected in the open air, especially in industrial districts, as the air-gap varies in length due to corrosion and deposits of coal and other dust. The pressure in the line cannot be relieved by a spark-gap by more than 20 per cent. if the series resistance is designed correctly to prevent surging at the frequency of the supply. Any form of arrester which involves a spark-gap is wrong in principle because of the high-frequency oscillatory disturbances caused by a spark in the circuit. Serious damage to plant may be caused by these disturbances.

Electrolytic aluminium arresters, combined with a horn arrester, have been used on a small scale, but their extensive use is limited by the fact that they need re-charging every day from the line, and this cannot be done, without considerable expense, from locked-up static sub-stations.

Moscicki condensers are coming into favour slowly, possibly because of their high first cost. They have been used by the North Wales Power and Traction Co. for some years with excellent results, and they are always installed as a matter of course on new lines. They have also been adopted recently by Messrs. Kennedy and Jenkin for the War Office lines from Tidworth to Bulford. The neat arrangement of this arrester on the terminal pole at Tidworth is shown in fig. 15. The condenser arrester is automatic in action and able to discharge rapidly high-frequency disturbances in the line, while it only needs occasional inspection for the replacement of any blown fuses. These condensers have not sufficient capacity to afford any improvement in the power factor of a line.

After much trouble with horn arresters, Messrs. Merz and McLellan have discarded arresters on all lines which are connected

to the system through step-up and step-down transformers, and instead about 10 per cent. of the end turns on the line side of the transformers are insulated with special materials to a thickness of 300 to 400 per cent. of the insulation on the remaining turns. Atmospheric disturbances on the line are reflected back by the end turns of the transformers, and the oscillations are damped out by the ohmic resistance of the line. Only a very high pressure on the line, *e.g.*, a direct lightning stroke, will break down the insulation, and in practice it is found that the outdoor insulators are punctured and the station apparatus is unaffected. The arrangement adopted is effective and cheap, and is easily worked in with the general design.

Probably some of the good results on all Messrs. Merz and McLellan's lines are due to their practice of connecting up their lines at both ends through paper-insulated cables, which have a very high resistance to breakdown when momentarily subjected to

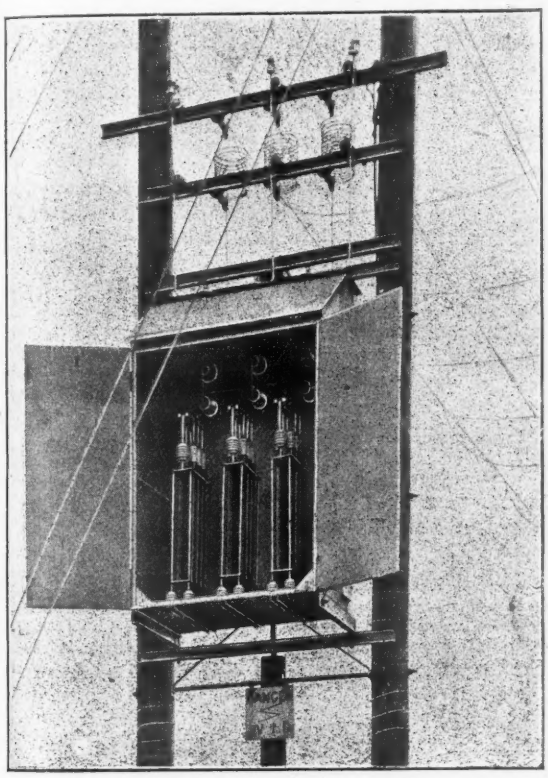


FIG. 15.—TERMINAL POLE, SHOWING MOSCICKI CONDENSER.

abnormal pressures. These cables have a low capacity and afford a permanent path to earth for high-frequency oscillations, and thus they are similar in action to the Moscicki condensers.

Private telephone circuits and circuits for the operation of the well-known Merz-Price protective gear may be combined in one paper-insulated cable protected by a lead sheath. The suspension of the sheathed cable is usually done from the steel-stranded continuous earth-wire when it is run below the power wires.

About 110 miles of lead-sheathed cable on transmission lines have been erected in the Newcastle district under the Elder system

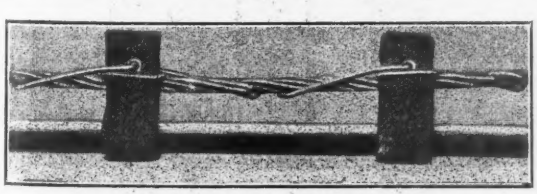


FIG. 16.—THE "ELDER" HANGER.

during the past two years, with such uniformly excellent results that it cannot be made too widely known. Briefly, the system consists of very short chrome-leather hangers which support the cable at every foot and which are prevented from having longitudinal movement by galvanised wire clips sprung on the suspension strand. On level routes every tenth hanger is also clamped to the cable by a galvanised flat spring clip, but on steep hills every hanger should be clamped. Fig. 16 shows the form of the Elder hanger usually employed.

In suspending lead-covered cables on spans exceeding 50 yards measures should be taken to secure that the cable has no severe bends in the vertical plane, as shown in fig. 2. At horizontal bends the cable must be carefully led round the curve by pull-offs on the suspension strand. At terminal poles provision must also be made to carry the cable round an easy bend from the horizontal to the vertical plane in such a way that no movement can take place which would crystallise the lead sheath. The lead sheath should be definitely bonded at every fifth pole to the supporting earth-wire in order to carry away any charges which may be induced in it by the power wires.

On lines which are not protected with automatic gear which requires a pilot cable for its operation and on which one metallic telephone circuit only is required, it is usual to run two No. 14 S.W.G. phosphor-bronze or hard-drawn copper wires, and of these copper is to be preferred. They may be rotated so as to

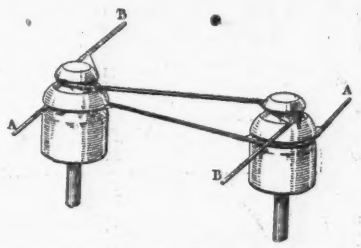


FIG. 17.—SHOWING A METHOD OF TRANSPOSITION OF TELEPHONE WIRES.

make one complete revolution at every fifth pole, but the author prefers the simpler plan of not rotating the telephone wires but running them parallel to one another and transposing them at such regular intervals as may be required (fig. 17).

When bare telephone wires are used the only instruments which are permissible are those known as high-tension telephones, which are specially insulated in order to make it impossible for the tele-

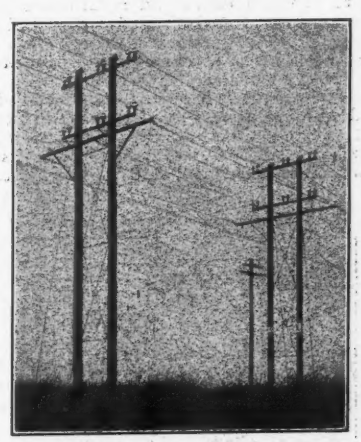


FIG. 18.—ROAD OR RAILWAY GUARDING.

phone user to get a shock due to the considerable voltage which is induced on these wires under normal working conditions, or to contact between the telephone and power wires. A much favoured high-tension telephone apparatus is that made by Messrs. Siemens Bros. & Co., Ltd. It is connected to the line through a transformer, and the sound is transmitted by insulated hearing tubes so that the user is not brought into contact with any current-carrying part of the apparatus.

When paper-insulated lead-sheathed cables are used for the telephone circuits, the much cheaper low-tension telephones of any good make may be employed, but it is advisable to protect them by heat coils, fuses, and spark-gaps. It is found that, under fault conditions on the line, the fault current partly travels through the lead sheath and sometimes induces current in the cores of the cables of sufficient magnitude to give severe shocks if the apparatus is not thus protected.

With the education of the public as to the safety of overhead wires, the methods of guarding lines crossing railways and roads are becoming much simplified, resulting in reduced cost of construction and enormous gain in appearance. One important 20,000-volt line which crosses a few roads and several miles of mountain moorland much used by tourists, has been equipped throughout with earthed extension pieces of galvanised wrought iron under each insulator. The metal projects for 12 in. on each side of the insulator and the curved portion is nearly semi-circular with a radius of 8 in.

The suspension guard shown in fig. 18 finds considerable favour for road and railway crossings and is extensively used by the Newcastle Electric Supply Co.

The suspender should be of the same sectional area and material as the line wire. It is anchored to the line wire at the

extreme ends and is also attached to it at intermediate points; it seems nearly impossible with this combination for a live wire to fall within reach from the ground. As a further protection, an earthed light cradle may be employed as shown in fig. 18, but it does not seem to be absolutely necessary.

The triangular guard shown in fig. 19 is a new arrangement which is due to Mr. A. P. Trotter, and has been used on the Ham line of the Twickenham and Teddington Electric Supply Co. and by the Fife Power Co. It has the merits of simplicity, low cost, and ease of erection, and is likely to find considerable favour in future work.

In cases where important G.P.O. lines are met with, the department requires that bare wires working at a pressure of 3,000 volts and above shall not cross its wires, except by special arrangement,

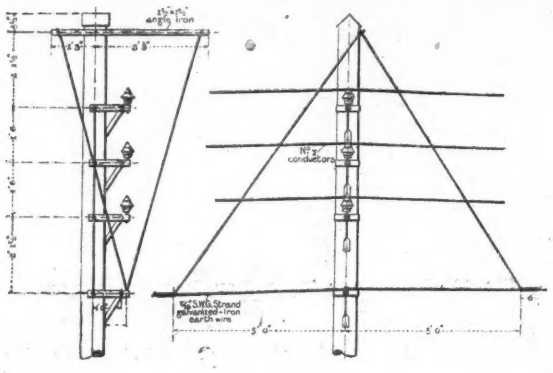


Fig. 19.—Triangular Guard.

thus involving serious expense in extra terminal poles and underground high-tension cables. In some cases, the department's requirements have been met by using a joint pole for both sets of wires. A good example of this by the Cornwall Power Co. is shown in fig. 20, in which the earthed metal screen between the wires and the caging round the high-tension wires will be noticed. For pressures below 3,000 volts the high-tension conductors may be erected above the department's wires by observing certain requirements.

With the great attention now given to the details of line construction, and with the equipment of lines with automotic protective apparatus, it is becoming exceedingly doubtful whether any guarding at all is justifiable on such lines. There is reason to believe that the line wires become "dead" within $\frac{1}{10}$ sec. after the

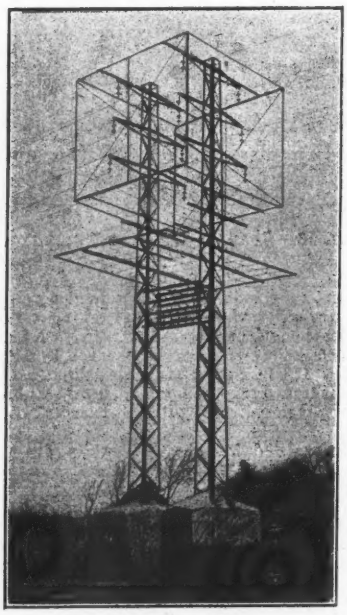


Fig. 20.—Combination Pole for High-tension Wires Above and G.P.O. Wires Below.

occurrence of a fault or short-circuit or the breakage of a wire when the Merz-Hunter split-conductor system is employed. The Merz-Price system will cut out the line within $\frac{1}{10}$ sec. when an earth fault or short-circuit occurs, but it will not deal with the case of the opening of a circuit by a wire breaking until the wire becomes earthed, which may not occur until the wire has reached the ground. Considering these facts, it would seem that the time is approaching when it will be justifiable to ask for the Board of Trade's consent to run high-tension lines along public roads where the conditions are suitable, and so save the enormous amount of trouble that is involved in obtaining numerous private wayleaves.

Where overhead lines cannot be connected directly to switchgear or transformers by bare conductors, the best practice is to connect up by means of paper-insulated lead-sheathed cables, built, when possible, to the Engineering Standards Committee's specification. These cables are usually armoured with galvanised wire for mechanical protection and to form an additional earthed metallic shield round the cable. The armouring should be protected against corrosion, preferably by compounded tapes. Such cables are also used for bridging across gaps in a line. Experience shows that even at 20,000 volts, three-phase, there is no need to make provision for protection against lightning where the cable and the line meet, and, further, that cables can be "teed" off an overhead line with safety.

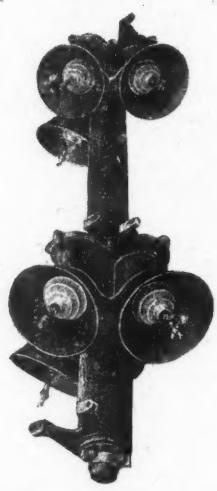


Fig. 21.—Inverted Type of Trifurcating Box Arranged for Split-conductor Working.

A cast-iron box fitted with insulators is employed on a terminal pole for sealing off the connecting cable at its junction with the line wires. Terminal boxes were very fruitful sources of breakdown until the introduction about three years ago of the inverted box, in which the porcelain insulator is considerably protected

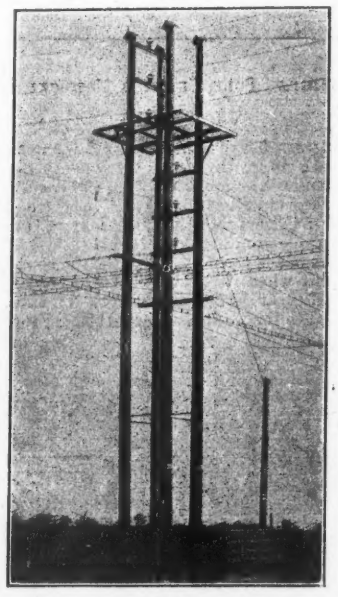


Fig. 22.—Arrangement for 20,000-Volt Circuit Crossing a 6,000-Volt Circuit.

from wet, snow, dirt, and mechanical damage. The author has never heard of a breakdown occurring at one of these boxes, which are obtainable for all pressures up to 20,000 volts, alternating current. A patented special form of the box for use with Merz-Hunter split conductor 20,000-volt cable is shown in fig. 21, and is also to be seen in actual use in fig. 2 on the terminal pole.

The very greatest care should be taken to ensure that all terminal boxes used out of doors are thoroughly filled with high-grade flexible waterproof compound, which will not soften appreciably under the direct rays of the sun.

Fig. 22 shows the design of a 4-pole structure which is in use for carrving a 20,000-volt line over a 6,000-volt line. The essential feature in it is the earthed metal platform between the two sets of conductors. Such a platform should be strong enough to permit of two men standing on it simultaneously.

Fig. 23 illustrates a neat method of leading-in bare conductors to a station without employing insulated cables. The three horizontal insulators are made in two parts, and these are mounted, as shown, on a vertical slate panel which is built into the wall.

Attention may be called to the fact that the Board of Trade allows a supply to be given from an overhead line through a transformer fixed overhead on a pole, subject to compliance with

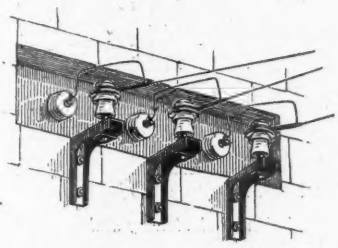


FIG 23.—METHOD OF LEADING-IN BARE CONDUCTORS TO STATION.

recently-issued regulations. This concession will probably be of much use when negotiations are on foot for obtaining wayleaves.

To prevent the climbing of poles, each separate pole should be equipped with about 10 turns of 4-barbed wire about 8 ft. above ground-level, and the wire should be securely stapled to it. In a few cases *chevaux de frise* have been used.

Each pole should have a zinc number-plate (G.P.O. pattern) attached to it by zinc nails, at a height of 5 ft. above the ground.

Danger notices must be fixed on at least one pole in five, and on each pole at a road crossing.

During erection some engineers prefer that wiremen shall use ladders, and not climbing irons, for going up the pole. This is a wise precaution, but it must be used with discretion. Usually it is sufficient to use ladders at terminal and corner poles. In very hilly country the use of ladders may make the cost of erection altogether disproportionate to the benefit derived.

Some engineers stipulate that the tops of poles are to be coated with a mixture of coal tar and creosote before the pole roof is fitted.

Where game guards are required to give warning to flying birds, it is better not to use metal guards, as their swinging has been found to cause cutting of the line wires. It is equally efficient to split and fix on each wire in a span two corks 3 in. long and 1¼ in. diameter. The fixing can be done by binding the two halves of the cork with binding wire.

During erection and during repair work, line wires should always be "earthed." Where this precaution has been neglected, some bad cases of shock to line men have been experienced, due to electrostatic charges on the wires.

On completion of erection of a line, it is advisable to subject it to a pressure-test at twice the working pressure for ½ hour, or else to make it alive at working pressure for, say, two days before commencing the supply of power.

DISCUSSION AT NEWCASTLE.

During the reading of his paper, MR. WELBOURN said that his remarks applied to overhead lines at pressures above 3,000 volts, as below this pressure the difference in cost between overhead and underground transmission was so little that cables were in more common use. In view of the importance of the subject, he suggested that it might be worth while for the Institution of Electrical Engineers to appoint a Committee to deal specially with overhead transmission lines. The Admiralty were very much alive to the danger of overhead lines to aviators, and had sent a representative to the London meeting especially to raise the question. With regard to factors of safety, he suggested that the working stresses should be proportional to the elastic limits of the materials used, and not to the ultimate breaking stress.

MR. V. P. HUNTER suggested that the price quoted for the 20,000-volt cable was much too high, and that it could be reduced by modifying the design of such cables, which, in his opinion, were made with too large a factor of safety. Quite a satisfactory job could be made for £1,550. He hoped that a committee on overhead line work would not be appointed, as the result would probably be an increase in the cost of such work. The factors of safety required by the Board of Trade were not by any means too liberal, and he did not think that anyone who had the responsibility of an overhead line would wish to reduce them. With regard to protection against atmospheric disturbances, he agreed that any device involving the use of an air-gap was quite wrong. His experience of lightning arresters in general had not been very satisfactory. He could not see how condensers could possibly be very effective. At one time it was looked upon as an expensive proceeding to have to install a short length of cable in order to pass under Post Office lines, but in view of more recent experience these short lengths of cable were now rather welcome, in view of their property of dissipating surges. As at least three responsible makers were now producing switches which would break circuits in the twenty-fifth part of a second, in the event of an overhead wire breaking, it would have to travel towards the ground at a rate of 300 miles per minute before it could do any damage, as the circuit would be completely broken long before the wire reached the earth.

MR. J. R. M. ELLIOTT said that he considered the route map shown in fig. 1 rather cumbersome, and that a pocket-book with leaves, say 6 in. × 4 in., each leaf containing particulars of one pole only, would be much more convenient to handle. The factors of safety used by the Post Office appeared to be quite in order, because the average breakage of lines all over the country was only once in ten years. He did not favour the use of steel poles, as it was impossible to inspect the inside of these, and men had been injured owing to breakages of apparently sound steel poles. The Post Office authorities had experimented with aluminium wires some years ago, but they were found to break off frequently at the insulators. Turning to the suggested test for hard-drawn aluminium conductors, he noted that no twisting test was suggested, although this was the only one on which reliance could be placed.

MR. H. BRIDGES said that for the suspension of pilot cables short hangers were absolutely necessary, as otherwise the suspension wires and the pilot cable swung at different rates, with the result that the lead sheathing very soon cracked.

MR. W. A. GILLOTT said that in the construction of overhead lines, one might supply the best material and design, but it was absolutely essential that the men should be well looked after, and that every attention should be given to details. He had noticed during storms that the proportion of snow and ice on aluminium lines was not so great as on the Post Office telegraph and telephone lines. In erecting poles, the use of spikes should be absolutely prohibited on account of the slight but painful injuries which might happen to men who had to climb the poles after erection.

MR. C. VERNIER said that the statement was often made that in many cases nothing was gained by centralising the plant, as the saving was balanced by the extra cost of transformers and lines, but, assuming the use of 20,000-volt overhead lines, a simple calculation would show that this was not the case. His own practice was never to lay a cable if an overhead line could be used; the maintenance of a well-constructed overhead line was very low indeed. He agreed with the author that it was quite a mistake to give a duplicate supply along the same route. He did not agree with running overhead lines along public roads, because these were very rarely straight, the Post Office lines usually occupied the whole of one side, and a considerable amount of space was required for first-class overhead construction, which meant that one had usually to overhang private ground, and this meant obtaining, and probably paying for, wayleaves. He was strongly adverse to the use of open telephone conductors, as these were a perpetual source of trouble owing to electrostatic phenomena. He thought that the cost of the erection, shown in fig. 20, must be very high indeed, and that it would have been cheaper to carry the power lines by means of cables underground at the crossings. He had abandoned the use of earth wires some three or four years ago, and had had very little trouble since. The four essential conditions to ensure that overhead pilot lines did not give trouble were:—(1) The sheathing must be of suitable material; (2) the hangers must be quite short, in order to prevent ripples; (3) the spacing must be quite short (not more than 18 in.); (4) the spacing must be regular.

MR. B. WELBOURN, in reply, said he agreed that in the Newcastle district, where the "Merz-Price" protective system and other refinements were in use, thinner dielectrics might be used, but this certainly did not apply to every district in the country. The thickness of the dielectric depended to a very large extent upon the radius of the conductor. With regard to open telephone lines, he had measured as much as 230 volts on telephone wires run below a 3,000-volt line. The early troubles which were experienced on the Post-Office aluminium lines were largely due to silica in the composition of the wire. The question of the twist test mentioned by Mr. Elliott was now being very carefully looked into by the makers of aluminium wire. The cost of maintenance of overhead lines, he believed, did not exceed 2 per cent. or 3 per cent. per annum. The privilege of being able to run power lines along public roads might in many cases help suppliers to short-circuit a landowner who was holding out for exorbitant wayleaves.

The Bradford Turbine Contract.—As stated last week, the Bradford Corporation has placed a contract with the ADNIL ELECTRIC CO., LTD., for a 5,000-KW. Bergmann turbo-generator set. This plant is to have a continuous output of 5,000 KW. at '8 P.F. The turbine is of the high-pressure type, and will be supplied with steam at 180 lb. per sq. in. pressure, superheated 100° F., and will exhaust into a condenser with a vacuum of 28 in. with the barometer at 30 in. The alternator is of the three-phase type, wound for 6,000/6,600 v., 50 cycles; whilst the normal load of the turbine is 5,000 KW., the generator is being so designed that it will safely develop 7,500 KW., or 9,375 K.V.A. without dangerous over-heating, and the speed of the combination will be 1,500 R.P.M.

TRADE STATISTICS OF ROUMANIA.

The following statement, showing the imports of electrical and similar goods into Roumania in 1911, is taken from the official trade statistics which have only recently been issued; the figures for 1910 are added for purposes of comparison, and notes of any increases or decreases are given. The predominance of German trade with Roumania in these goods will be immediately noticeable:—

	Kilogs. 1910.	Kilogs. 1911.	Kilogs. Inc. or dec.
Electrical insulators of faience and porcelain even combined with other materials.—			
From Austria ...	63,000	49,000	— 14,000
,, Germany ...	79,000	72,000	— 7,000
,, Italy	1,000	—	— 1,000
,, Other countries	3,000	1,000	— 2,000
Total ...	146,000	122,000	— 24,000
Boilers.—			
From Great Britain...	26,000	22,000	— 4,000
,, Austria ...	86,000	70,000	— 16,000
,, France ...	7,000	7,000	—
,, Germany ...	421,000	316,000	— 105,000
,, Other countries	1,000	3,000	+ 2,000
Total ...	541,000	418,000	— 123,000
Iron wire, galvanised, &c.—			
From Great Britain..	48,000	97,000	+ 49,000
,, Austria ...	103,000	187,000	+ 84,000
,, Belgium ...	9,000	—	— 9,000
,, Germany ...	330,000	530,000	+ 200,000
,, Holland ...	2,000	—	— 2,000
,, Other countries	1,000	9,000	+ 8,000
Total ...	493,000	823,000	+ 330,000
Electric incandescent lamps.—			
From Austria ...	6,000	8,000	+ 2,000
,, Germany ...	16,000	20,000	+ 4,000
,, Other countries	1,000	1,000	—
Total ...	23,000	29,000	+ 6,000
Copper wire.—			
From Great Britain..	66,000	30,000	— 36,000
,, Austria ...	22,000	45,000	+ 23,000
,, Germany ...	83,000	166,000	+ 83,000
,, Other countries	3,000	2,000	— 1,000
Total ...	174,000	243,000	+ 69,000
Steam engines.—			
From Great Britain..	7,000	113,000	+ 106,000
,, Austria ...	69,000	1,813,000	+1,744,000
,, Germany ...	2,398,000	3,949,000	+1,551,000
,, Other countries	50,000	111,000	+ 61,000
Total ...	2,524,000	5,987,000	+3,462,000
Petroleum engines.—			
From Great Britain..	817,000	601,000	— 216,000
,, Austria ...	600,000	259,000	— 341,000
,, Belgium ...	163,000	4,000	— 159,000
,, Germany ...	1,159,000	1,603,000	+ 444,000
,, Switzerland ...	257,000	322,000	+ 65,000
,, Other countries	87,000	234,000	+ 147,000
Total ...	3,083,000	3,023,000	— 60,000
Gas, compressed air, &c., engines.—			
From Great Britain..	62,000	55,000	— 7,000
,, Austria ...	27,000	46,000	+ 19,000
,, Germany ...	165,000	225,000	+ 60,000
,, Switzerland ...	7,000	41,000	+ 34,000
Total ...	261,000	367,000	+ 106,000
Dynamo-electric machines, electric motors, converters, transformers, &c.—			
From Great Britain..	1,000	59,000	+ 58,000
,, Austria ...	20,000	25,000	+ 5,000
,, Belgium ...	9,000	1,000	— 8,000
,, France ...	5,000	60,000	+ 55,000
,, Germany ...	711,000	1,137,000	+ 426,000
,, Other countries	3,000	22,000	+ 19,000
Total ...	749,000	1,304,000	+ 555,000
Accumulators and spare plates.—			
From Austria ...	226,000	134,000	— 92,000
,, France ...	1,000	7,000	+ 6,000
,, Germany ...	22,000	88,000	+ 66,000
,, Other countries	2,000	5,000	+ 3,000
Total ...	251,000	234,000	— 17,000
Arc lamps.—			
From Austria ...	1,000	2,000	+ 1,000
,, Germany ...	8,000	17,000	+ 9,000
,, Other countries	—	1,000	+ 1,000
Total ...	9,000	20,000	+ 11,000
Electric apparatus for telegraphs and telephones.—			
From Austria ...	2,000	4,000	+ 2,000
,, Germany ...	8,000	33,000	+ 25,000
,, Other countries	2,000	4,000	+ 2,000
Total ...	12,000	41,000	+ 29,000
Ditto for transmission of power and light.—			
From Austria ...	2,000	2,000	—
,, Germany ...	18,000	16,000	— 2,000
,, Other countries	—	2,000	+ 2,000
Total ...	20,000	20,000	—
Interrupters, &c.—			
From Austria ...	7,000	11,000	+ 4,000
,, Germany ...	72,000	110,000	+ 38,000
,, Other countries	3,000	5,000	+ 2,000
Total ...	82,000	126,000	+ 44,000
Cables for transmission of electricity and insulated wire.—			
From Great Britain..	1,000	6,000	+ 5,000
,, Austria ...	51,000	180,000	+ 129,000
,, Germany ...	692,000	782,000	+ 90,000
,, Belgium ...	18,000	3,000	— 15,000
,, Other countries	4,000	1,000	— 3,000
Total ...	766,000	972,000	+ 206,000
Rails for tramways and railways.—			
From Austria ...	1,373,000	11,011,000	+9,638,000
,, Belgium ...	1,031,000	2,721,000	+1,690,000
,, Germany ...	4,442,000	3,682,000	— 760,000
,, Holland ...	1,258,000	267,000	— 991,000
,, Russia ...	6,216,000	—	—6,216,000
,, Other countries	87,000	119,000	+ 32,000
Total ...	14,407,000	17,800,000	+3,393,000
Locomobiles.—			
From Great Britain..	1,010,000	1,506,000	+ 496,000
,, Austria ...	1,143,000	1,041,000	— 102,000
,, Germany ...	1,096,000	1,480,000	+ 384,000
,, Other countries	19,000	160,000	+ 141,000
Total ...	3,268,000	4,187,000	+ 919,000
Electric apparatus for bells.—			
From Austria ...	2,000	1,000	— 1,000
,, Germany ...	3,000	9,000	+ 6,000
,, Other countries	—	1,000	+ 1,000
Total ...	5,000	11,000	+ 6,000
Electric batteries for medicine and chemistry.—			
From Austria ...	1,000	—	— 1,000
,, Germany ...	2,000	6,000	+ 4,000
,, Other countries	—	2,000	+ 2,000
Total ...	3,000	8,000	+ 5,000
Accessories for dynamo electric machines.—			
From Great Britain..	—	1,000	—
,, Austria ...	—	12,000	—
,, Germany ...	—	62,000	—
,, Other countries	—	3,000	—
Total ...	46,000	78,000	+ 32,000

Callender's Hospital Fund.—We have received a copy of the eleventh annual report and statement of Callender's Hospital and Distress Fund, which was unanimously adopted at the general meeting held on January 24th, at the Belvedere Works. Mr. A. R. Kibblewhite presided. In penny subscriptions the sum of £272 was received, a decrease of £4 as compared with the previous year. Donations, including one of £50 from the firm, amounted to £72. £241 was distributed to hospitals and other institutions, and various sums were expended in providing surgical appliances, spectacles, and financial assistance. It was anticipated that as the medical benefits under the National Health Insurance Act commenced in 1913, there would not be so great a demand on the fund for hospital letters, but actually a larger number have been issued than in any previous year.

OVERHEAD WIRE CONSTRUCTION FOR MEDIUM AND LOW PRESSURES.

THE discussion on the paper by MR. A. P. TROTTER (see ELEC. REV., p. 157) was opened by MR. A. J. STUBBS, who said he was pleased to see that the cross wires should be 5 ft. from the pole, so that they could be reached from a ladder. He asked how one wire could be earthed and the other not earthed when the two were connected across at every span. The Post Office Regulations for 1905 were intended to afford protection from trolley wires, but a loophole was left to meet the case of other power wires. The "low" insulation of the earthed wire must not be "no" insulation; it must be sufficiently high to enable the system to be tested. They must not forget the protection of the lead-off to consumers' premises.

MR. W. A. CHAMEN expressed the thanks of supply engineers to Mr. Trotter for his sympathetic treatment of the various questions that arose, and said that they were all grateful to him. He (Mr. Chamen) had been dealing with low-pressure three-phase distribution for the last few years. He thought fig. 9 would be a convenient method, but it would not comply with the regulation regarding the angle of 45°. With regard to fig. 10 and others of the same nature, he had never seen this arrangement in practice, and was doubtful whether it could be made safe. He had experimented with fig. 13, and it seemed to work well where the neutral was at the bottom, but if it were drawn tight it pulled up the wire and reduced the clearance. Fig. 14 looked the best, but was no good if the neutral was at the top. Fig. 15 was produced in Mr. Chamen's office, and seemed likely to be the safest for five wires. The arrangement of four wires in a rectangle with the fifth wire below was horrible, especially for services and at cross-roads. The best arrangement was to have the wires in a vertical plane, with the switch wire and the neutral at the bottom. Fig. 15 was quite neat and unobtrusive. The idea of using one guard wire as a switch wire was horrifying to him; it made the circuit alive and dangerous. He agreed with Mr. Stubbs regarding the difficulty of dealing with branch circuits; they must have guard wires, which doubled the number of wires and looked unsightly. Would insulated (covered) wire be accepted at such places?

MR. WELBOURN doubted whether alternating pressures above 150 volts should be allowed on overhead distributors. He preferred the split neutral to the zig-zag. To his own knowledge, one conductor had been used as a switch wire, but it was only possible on A.C. circuits.

MR. J. SINNOTT said that over 40 experiments had been made with systems of protection covering the reduction from 24 to 8 in., and they had been found efficient in practice. The arrangement shown in fig. 15 was quite safe.

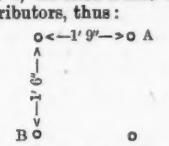
MR. C. L. E. STEWART (Rawtenstall) said that overhead work must be done in a really workmanlike way. It would have been impossible to carry out the street lighting at Rawtenstall, except with overhead wires. In the case of tramways, parallel guarding was quite a different thing from cross wires. There was a danger of guard wires breaking and slipping back, forming loops which were very dangerous to persons driving along the roads; the guard wires should be anchored at frequent intervals. He had four guard wires running for 6 miles over trolley wires, and all sorts of things happened to them. There was a liability for cradle wires to swing in the wind and cause short circuits. A clearance of 3½ in. between wires was not enough; the distance should be such that the wires could not blow together. The reel insulation shown in fig. 6 had proved quite satisfactory, even under very adverse conditions. He was grateful to Mr. Trotter for kind assistance, and also to the Post Office engineers.

MR. HAYDN HARRISON said that continuity of all the services was important; why should electric light wires be guarded, rather than telegraph wires? Where isolated house transformers were used, protection was provided on consumers' premises; but in the case of overhead wires, the protection was placed at the point where the trouble might arise; why should this be so? Surely all this trouble could be avoided by protecting the telephone and telegraph operators at the places where they worked. The protection of overhead electric light wires was becoming more and more important. The difficulty of erecting overhead wires had always held back the development of electric lighting. After all the necessary guards had been put up, the Post Office called upon them to pay for putting fuses and heat coils on the telephone wires! On the Continent and in America they would see very little of guard wires. He had not used the neutral as a switch wire, but had momentarily removed the earth connection from the neutral to switch lamps on. The neutral should be well insulated, as at some time it might be necessary to work with the outer earthed. He asked whether insulated wire would be accepted by the Post Office as sufficiently guarded, so as to avoid the use of unsightly guard wires, and suggested that if No. 14 S.W.G. was too small for electric light wires, it was too small for telephone wires.

MR. S. BARTHOLOMEW said that fuses and guard wires were necessary because there was danger at two points; fuses would protect the apparatus, but not the public or the lines. The Post Office accepted the simplest guarding, supplemented by fuses and heat coils. Until last year no lineman of the Post Office had been killed; and where the fatality occurred there were no guard wires. The devices shown would not protect telephone wires under the line, unless fig. 4 was used, making a stiff cradle with the bights. With recent progress in telegraphy stray currents had more serious effects than formerly, hence the connection to earth at more than one point was objected to. Continuously insulated wires were not permanently satisfactory, but were accepted if hung from suspenders. In America it was a common thing to kill members of the public, due to the lack of such precautions as those of the Board of Trade. They had to be chary of making concessions, as vested interests were quickly built up on them.

MR. WILKINSON said he regarded the publication of the paper as of great importance. He knew the difficulties experienced at Rawtenstall, and appealed to engineers to make overhead work as neat as possible.

MR. DONKIN said that split neutral services were very expensive. He had tried crossing the service wires, but that did not constitute a perfect safeguard. Would Mr. Trotter accept wire catchers fixed on the lower earthed wire? With regard to the spacing shown in fig. 4, he cited a case where two heavy feeders were run over two distributors, thus:



The wires A and B came into contact, and B fell.

MR. WIGHAM said that the overhead wiring for lighting a village cost £75, and the guard wires £23; that was too heavy a tax. One way of guarding wires used for low-pressure work was to erect a fouling frame on the pole; this worked well with suspension insulators. It was difficult to make loop connections taut.

In reply to the discussion, MR. TROTTER agreed that the cross wire in figs. 7 and 8 had to be insulated from the earth wire, and that the earth wire should be efficiently insulated. He approved of the vertical arrangement of Mr. Chamen's mains, and agreed that fig. 9 did not comply with the 45°. There was also a risk of short-circuits. If the special insulated wire under trial by the Post Office for telephone wires over electric light wires proved satisfactory, it would be a help. The zig-zag system had been superseded. A vertical clearance of 12 in. was sufficient for fig. 15. The Board of Trade Regulations had always ignored continuously insulated wire, and required wires to be safe as if they were bare; but the Post Office experiments might change this. It had been proved that 230 volts A.C. was a fatal pressure. He did not care for the wire-catcher.

THE WIRELESS SOCIETY OF LONDON.

A MEETING was held at the Institution of Electrical Engineers on January 21st to hear the presidential address of Mr. A. A. Campbell-Swinton. The address was largely experimental, and during the evening there was made audible and visible to the audience the reception by telephone and siphon recorder of the diurnal weather report from the Eiffel Tower; messages of congratulation and goodwill from Commandant Ferrié (Eiffel Tower), and the London Telegraph Training College (Earl's Court); and sundry violent and unintelligible messages from the Admiralty.

In commencement, the President congratulated the Society on its first two honorary members, Sir William Crookes and Sir Oliver Lodge. Sir William's memorable article on the possibilities of wireless, published in the *Fortnightly Review* in February, 1892, had proved an extraordinarily accurate prediction, and Sir Oliver Lodge was the first publicly to send signals, ring bells and deflect galvanometers by aid of Hertzian waves.

Only the extreme delicacy of receiving instruments, he said, had made wireless telegraphy possible. The reading of wireless messages by ear, particularly at high speeds, was by no means easy, hence special interest attached to various methods of recording messages. Manometric flames actuated by telephonic vibrations received on the diaphragm of a manometric chamber were extraordinarily sensitive, and it was easy by their aid to record, photographically, messages received by telephone. Alternatively the jumping flame might be used in conjunction with a thermal couple or a paper band treated with sympathetic ink. Signals might be recorded by photographing the spot reflected by a high-frequency moving-coil galvanometer. During the address numerous slides were exhibited to show records of messages made by every method described.

When using small aerials or receiving very weak signals on larger aerials, it was desirable to use some form of relay. The action of the Heurtley thermal relay, and of the Orling jet relay, was described briefly, and a number of most successful demonstrations were made with the Brown "A," "G" and "W" types of relays, the action of which was described in greater detail. In conjunction with these relays was used a Kelvin siphon recorder, the working of which was shown to the audience by means of an epidiascope lent by Messrs. Leitz. This was the first occasion on which was given such a public demonstration of recording wireless messages. To actuate the recorder, all three types of Brown relay were used in cascade, a telephone being connected to the "G" relay and the "W" relay being adjusted actually to break contact. The note of the Eiffel Tower signals being very low, the recorder showed ripples corresponding to each transmitting spark; special damping was required to eliminate such analysis. By chance the simultaneous arrival of signals from the Admiralty and the Eiffel Tower demonstrated beautifully the fact that the telephone discriminated between two messages of different acoustical pitch, whereas the siphon recorder gave a resultant curve incapable of analysis, and therefore unintelligible.

The Morse inker could be used to record wireless messages, but it should be arranged so that the inker circuit was broken when a signal was *received* (the magnets being placed *above* the armature so as to retain ordinary signals, viz., long and short black lines). Otherwise, the breaking of the inker circuit when a signal ceased actuated the relays, and thus caused the inker to work continuously like a trembler bell. Given a sufficiently large aerial or suitable relays, messages could be recorded by a phonograph. Phonograph records were very useful in practising reception at various speeds; this system was actually employed in the Marconi Schools. The action of Poulsen's telegraphone, and the sensitivity and application of the Einthoven galvanometer, were described and illustrated. The Einthoven galvanometer is sensitive to a power expenditure of one-billionth of a watt (1 second is about one-billionth of 3,200 years); the human eye could detect about one-sixth of this amount of power; photographic action had advantage only in respect of the cumulative effect obtainable by prolonged exposure. Lord Rayleigh had shown that the human eye and ear were of the same order of sensitiveness, and the telephone was of the greatest importance as a receiver of wireless messages. The actuation of whistles and organ pipes by wireless signals and relays was demonstrated, and the President stated that he contemplated the public announcement of time signals by this means from his own wireless installation. The checking of chronometers by observing coincidences between wireless and pendulum beats (see ELECTRICAL REVIEW, Vol. LXX, page 564 *et seq.*), was demonstrated; by this means it is possible to check chronometers within $\frac{1}{100}$ second—a point of great importance in navigation and cartography, &c.

In concluding his address, the President indicated briefly the difficulties in the way of realising long-distance wireless telephony, and surmised that trans-Atlantic telephony when realised would be wireless, while, in the not distant future, we might have public halls supplied with speeches, &c., by long-distance wireless telephony. It was difficult to imagine how efficiency could be secured in the wireless transmission of power, but no less than 7,000 H.P. per acre was received in the form of electromagnetic waves from the sun on a clear day, hence there was a substantial basis for hopes of future success.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

815. "Electric Resistances." H. SNOWDON. January 12th.

840. "Manufacture of Cartridge-Cases." S. O. COWPER-COLES. January 12th.

841. "Manufacture for Use in Electrolytic Production of Metal Tubes and the Like." S. O. COWPER-COLES. January 12th.

842. "Means for Removing Metallic Cylinders from Mandrels on which they are Electro-Deposited." S. O. COWPER-COLES. January 12th.

843. "Process for the Manufacture of Hollow Iron Articles." S. O. COWPER-COLES. January 12th.

875. "Electric Cells and Batteries." Q. MARINO. January 12th.

895. "Machine Telephone Switching Systems." WESTERN ELECTRIC CO., LTD. (F. T. WOODWARD, Belgium). January 12th. (Divided Application on 5,653/13. March 6th.)

900. "Self-Locking Electric-Lamp Holder." F. CACHA. January 13th.

901. "Construction of Electric Conductor Rails, Safety Guards, and Contact-shoes for Electric Railways, Tramways, and the Like." J. A. F. ASPINALL. January 13th.

919. "Polarised Instruments." I. H. PARSONS. January 13th.

925. "Electric-Current Controllers and Like Apparatus." G. ELLISON. January 13th.

927. "Time-Controlled Electric Switches and Recording-Registers." H. B. MCCABE. January 13th. (Complete.)

945. "Time Switches." J. E. H. BERAUD. January 13th. (Convention date, January 23rd, 1913, France.) (Complete.)

953. "Switchboards." S. A. GREEN. January 13th.

963. "Electrically-driven Vehicles" KALMAN VON KANDO. January 13th. (Complete).

967. "Machines for Generating Electrical Energy." H. WADE (C. T. MASON, United States). January 13th.

970. "Switches for Electric Hand Lamps and the Like." G. F. HITZELBERGER AND NEW BRITISH EVER-READY CO., LTD. January 13th. (Complete.)

971. "Means for Locking Hand-Ropes for Lifts and the Like, by means of Electric Control." M T. MEDWAY. January 13th.

973. "Telephones." C. B. WILSON. January 13th.

1,008. "Electric Switch." A. C. GREENE. January 14th.

1,033. "Device for Supporting and Holding Telephonic Receivers when in Use." S. SCHARFF & I. SIMONS (commonly known as ARTHUR SIMONS). January 14th.

1,056. "Methods of Making Air-tight Joints Between Metal and Glass." BRITISH THOMSON-HOUSTON CO., LTD. (Allgemeine Elektricitäts-Ges., Germany). January 14th.

1,062. "Process for Manufacturing a Mass of Higher Oxygen Compounds of Nickel for Use in the Positive Electrodes of Alkaline Accumulators." SVENSKA ACKUMULATOR AKTIEBOLAGETUNGNER. January 14th. (Convention date, January 16th, 1913. Sweden.) (Complete.)

1,119. "Electrical Accumulators." C. DE SEDENEFF. January 15th. (Divided application on 1,066/13. January 4th.) (Complete.)

1,133. "Insulating-Material." F. ROWLEY AND SANRAINE SYNDICATE, LTD. January 15th.

1,137. "Plug Contact for Electrical Cooking-Utensils." H. VOIGT. January 15th.

1,143. "Supports for Electrical Conductors or Other Purposes." CALLENDER'S CABLE & CONSTRUCTION CO., LTD., AND C. W. KAY. January 15th.

1,154. "Circuit Controlling Apparatus." WESTERN ELECTRIC CO., LTD. (F. T. Woodward, Belgium). January 15th. (Complete.)

1,157. "Telephone Systems." SIEMENS & HALSKE AKT-GES., E. A. LAIDLOW & T. PETTIGREW. January 15th. (Addition to 18,498/12.) (Complete.)

1,158. "Apparatus for Recording Number of Telephone Calls." A. J. FITZGERALD AND E. G. FITZGERALD. January 15th.

1,163. "Electric Dinner or Service Lifts." F. HODGSON. January 15th.

1,169. "Wireless Telegraph or Telephone Systems." W. H. SHEPHARD AND A. E. MCKECHNIE. January 15th.

1,174. "Combined Starters, Dynamos, and Ignition Timers for Use with Internal-combustion Engines." G. R. WADSWORTH. January 15th. (Complete).

1,176. "Contact-Clock Switch Device for Altering the Times for Switching." ALLGEMEINE ELEKTRICITÄTS-GES. January 15th. (Convention date, January 15th, 1913, Germany.) (Complete.)

1,181. "Method of Producing Movements of an Indicator or the Like in Electric Aparatus or Other Instruments." W. LUBACH. January 15th. (Complete.)

1,187. "Two-Rate Electric Meters for Either Continuous or Alternating Current and with Prepayment or Not." M. POINELLI. January 15th.

1,227. "Dynamo-Electric Starting-Mechanism for Internal Combustion Engines." H. LUCAS & W. C. TURNER. January 16th.

1,228. "Dynamo-Electric Starting-Mechanism for Internal Combustion Engines. H. LUCAS AND W. C. TURNER. January 16th.

1,238. "Electric-Current Regulators." P. FINCATO. January 16th. (Convention date, January 16th, 1913, Italy.) (Complete).

1,241. "Metal Conduits for Electrical Conductors." R. N. CUNNINGHAM. January 16th.

1,248. "Resistance Apparatus for Electric Motor Starters, Rheostats, and the Like." W. GEIPEL AND C. J. MARGERISON. January 16th. (Complete.)

1,252. "Incandescent Lamps." G. M. J. MACKAY. January 16th. (Convention date, September 8th, 1913, United States). (Complete).

1,290. "Insulated Electrical Conductor for Signalling in Mines and Similar Places from Any Point on Length of Conductor." W. HARRISON & F. J. RAE. January 17th.

1,295. "Electrical Resistances." I. VILASTO, T. CLARK & W. WATSON. January 17th.

1,319. "Support for Electrical Conductors." C. HAMILTON. January 17th.

1,341. "Dynamo-Electric Machines." A. H. MIDGLEY & C. A. VANDERVELL. January 17th.

1,347. "Metallic Compounds and Processes of Producing the Same." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States). January 17th.

1,362. "Starting Rotary Converters." PHŒNIX DYNAMO MANUFACTURING CO., LTD., & R. POHL. January 17th.

1,363. "Coin-Actuated Mechanism." R. C. GRIESBACH AND VENNER TIME SWITCHES, LTD. January 17th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

22,036. ALARM DEVICES FOR USE WITH WIRELESS TELEGRAPH SYSTEMS. W. H. Shephard and A. E. McKechnie. September 27th.

24,563. ELECTRIC IGNITION DEVICES. W. Mordey. October 26th.

24,971. ELECTRIC CANDLE LAMPS. H. Garde. October 31st.

27,310. DAYLIGHT SIGNAL LAMP. A. J. Stevens, A. A. Lyon and Goldenlyte, Ltd. November 27th.

29,774. ELECTRIC CABLE CONNECTING-BOXES OR APPARATUS. British Insulated and Helsby Cables, Ltd., and R. W. Blades. December 27th.

29,839. VACUUM VALVE TUBE RECTIFIERS. W. J. Mellersh-Jackson (Caldwell). December 27th.

29,874. DEVICE FOR RECORDING TELEPHONE CALLS. G. H. Parry. December 28th.

1913.

19. GEAR FOR ELECTRICALLY OPERATING MACHINE TOOLS AND THE LIKE. J. P. Hall. January 1st.

80. ELECTRIC INCANDESCENT LAMP-HOLDERS. S. W. Martyn. January 1st.

91. COILS, PARTICULARLY COILS FOR ELECTRICAL PURPOSES, AND THE METHOD OF MANUFACTURING THE SAME. M. Helm. January 1st. (Convention date not granted.)

212. CASINGS FOR ELECTRICAL SWITCHES. P. S. Turner. January 3rd.

316. TELEGRAPHY. E. S. Heurtley. January 4th.

331. PROCESSES OF ELECTRIC WELDING. G. Grüchtel. January 6th.

333. SPARKING PLUGS. J. H. Runbaken. January 6th. (Cognate Application, 15,587/13.)

974. CHEMICAL REACTIONS IN GASES BY MEANS OF ELECTRIC ARCS. J. Y. Johnson. (Badische Anilin & Soda Fabrik.) January 13th.

1,855. ELECTRIC MEASURING INSTRUMENTS OF THE MERCURY MOTOR TYPE. British Thomson-Houston Co. and A. P. Young. January 22nd.

2,170. ELECTROMAGNETIC TYPEWRITERS. J. Schnyder. January 27th. (January 29th, 1912.)

3,883. AUTOMATIC TRANSMITTERS FOR TELEGRAPHIC SIGNALS. Creed Bille & Co. (Bille). February 14th.

4,091. MACHINES FOR WINDING COILS, PARTICULARLY COILS FOR ELECTRICAL PURPOSES. M. Helm. February 17th. (Convention date not granted. Divided application on 91/13. January 1st.)

6,891. SYNCHRONOUS DYNAMO-ELECTRIC MACHINES. E. Rosenberg. March 20th.

7,059. ELECTRIC INCANDESCENCE LAMPS. H. Zschocke. March 25th.

7,213. TROLLEYS OR COLLECTORS FOR ELECTRICITY. M. E. Drake and D. B. Burnett. March 26th.

8,675. HIGH POTENTIAL ELECTRICAL INSULATORS. British Thomson-Houston Co. (General Electric Co.). April 12th.

8,865. ELECTRIC CONTROLLING VALVE FOR AIR-BRAKES. H. Gallusser. April 15th. (April 17th, 1912.)

8,964. IGNITION DYNAMOS. C. T. Mason. April 16th. (Addition to 8,198/13.)

10,157. FORM OF ELECTRIC ANNUNCIATOR AND CIRCUIT CHANGER. E. E. Moore. April 30th.

11,579. SELECTOR ARRANGEMENT FOR SEVERAL STATIONS LYING ON A COMMON LINE. C. Beckmann & Akt. Ges. Mix & Genest. May 19th.

11,737. SPARK PLUGS. L. J. Dirand. May 20th. (October 29th, 1912.)

12,121. ELECTRIC MOTOR CONTROL SYSTEM FOR MACHINES WITH RECIPROCATING MOTION. "Vulkan" Maschinenfabriks-Akt. Ges. May 24th. (June 7th, 1912.)

13,344. ADVERTISING OR SIGN-DISPLAYING APPARATUS. K. Euker. June 9th.

14,091. CASING FOR POCKET BATTERY LAMPS. C. R. Zumpe. June 18th.

16,376. COIN-FREED PREPAYMENT DEVICES FOR TELEPHONE SYSTEMS. Siemens and Halske Akt. Ges. July 16th. (July 17th, 1912.)

17,927. OPTICAL PYROMETERS. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.). August 6th.

18,819. ELECTRICALLY-PROPELLED ROAD VEHICLES. E. Cross. August 19th.

20,912. COMMUTATOR TRUEING DEVICES. F. G. Ludwig. September 16th.